AIR CONDITIONING HEATING AND VENTILATING

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT
for
AIR CONDITIONING
HEATING • VENTILATING
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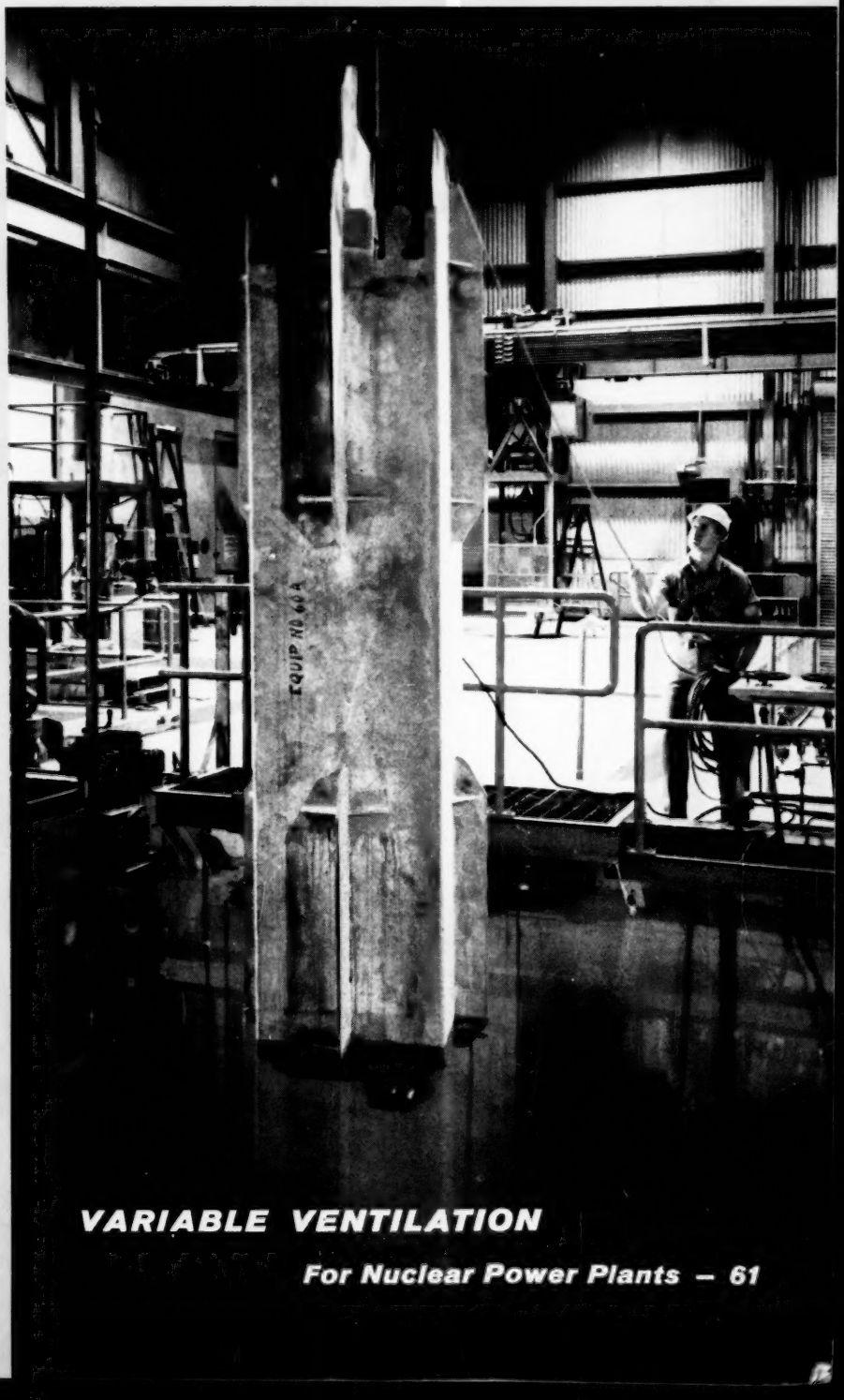
DECEMBER, 1961

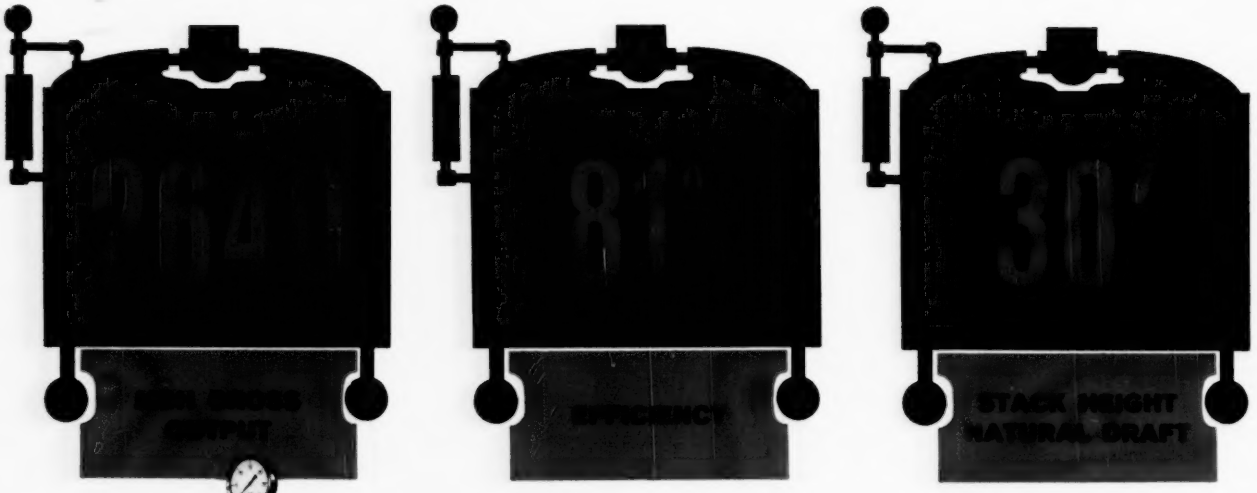
CEILINGS AND
AIR CONDITIONING:

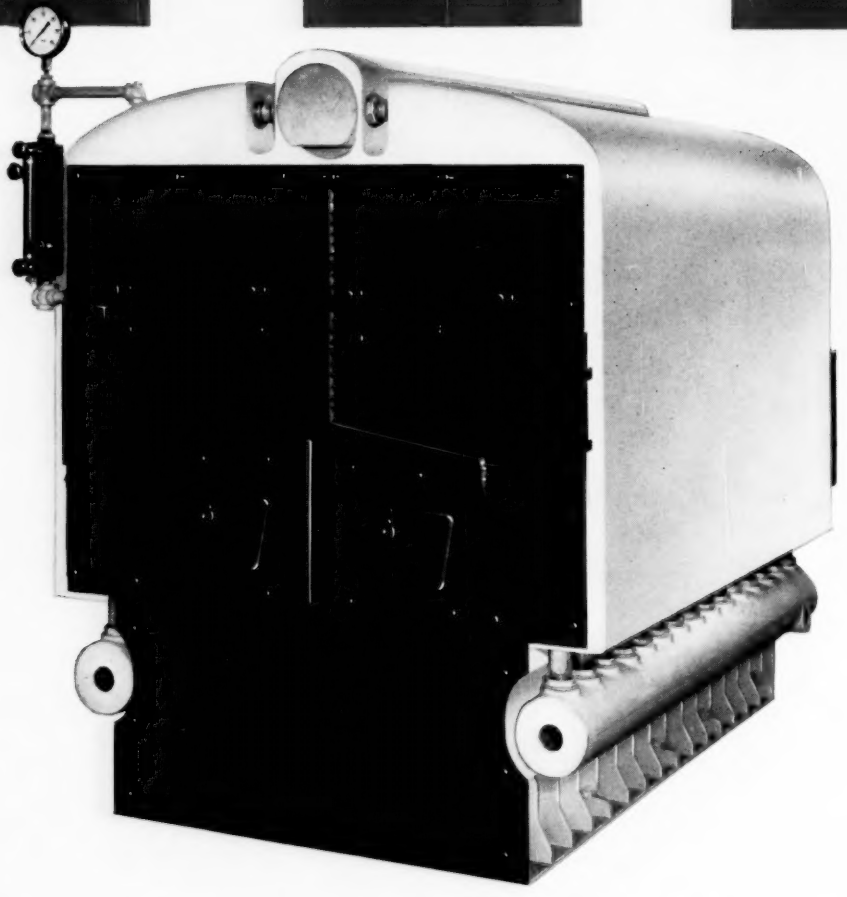
Unscrambling Heat and Light 51

Controlling Radiant Ceiling Panels . . 54



VARIABLE VENTILATION
For Nuclear Power Plants — 61





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Yes, that's what a 13-section '450' Mills boiler will do. Compare the necessary chimney height with *any other* boiler of its size—cast iron or steel—and see what savings can be achieved by specifying a *LOW DRAFT LOSS* H. B. Smith '450'.

Other sizes of this remarkable new boiler range from 1584 MBH to 4120 MBH output with chimney heights from 25 to 37 feet.

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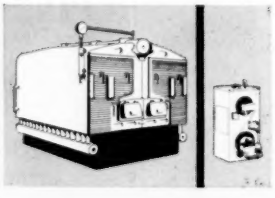
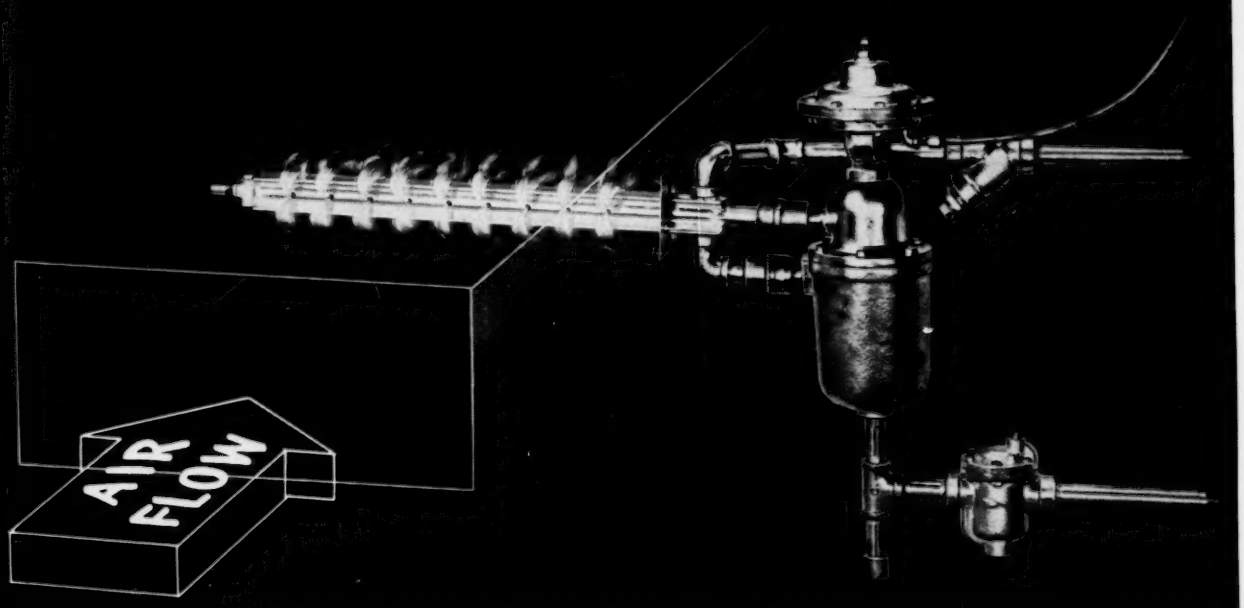
COMPANY, INC.
WESTFIELD, MASSACHUSETTS

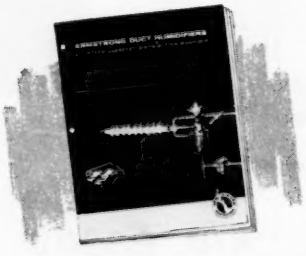


A new effective answer
to trouble-free humidification
in heating and air conditioning systems . . .



ARMSTRONG DUCT HUMIDIFIERS

with steam jacketed distribution manifold



Bulletin 504 gives complete data on Armstrong Duct Humidifiers . . . how they work . . . how they avoid duct condensation . . . dimensions . . . capacities . . . sizing information . . . and how they can be installed. . . . Ask for a copy.

The Armstrong Duct Humidifier with steam jacketed distribution manifold answers the most critical requirements of duct humidification by providing—

1. A drip-free means of introducing water vapor to the air flow in the form of dry steam.
2. Uniform distribution of moisture across the width of the duct to avoid condensation points.
3. Accurate, responsive control of the amount of water vapor introduced into the air flow.
4. Moderate first cost, minimum maintenance and low operating cost.

Armstrong Duct Humidifiers are offered in two sizes, and are either air operated or electrically operated. Stainless steel distribution manifolds are furnished in seven lengths from 1 foot to 6 feet. Capacities are set to avoid the possibility of duct condensation.

We will be pleased to have your nearby Armstrong Representative show you how your clients will benefit from Armstrong humidification. Call or write, today.

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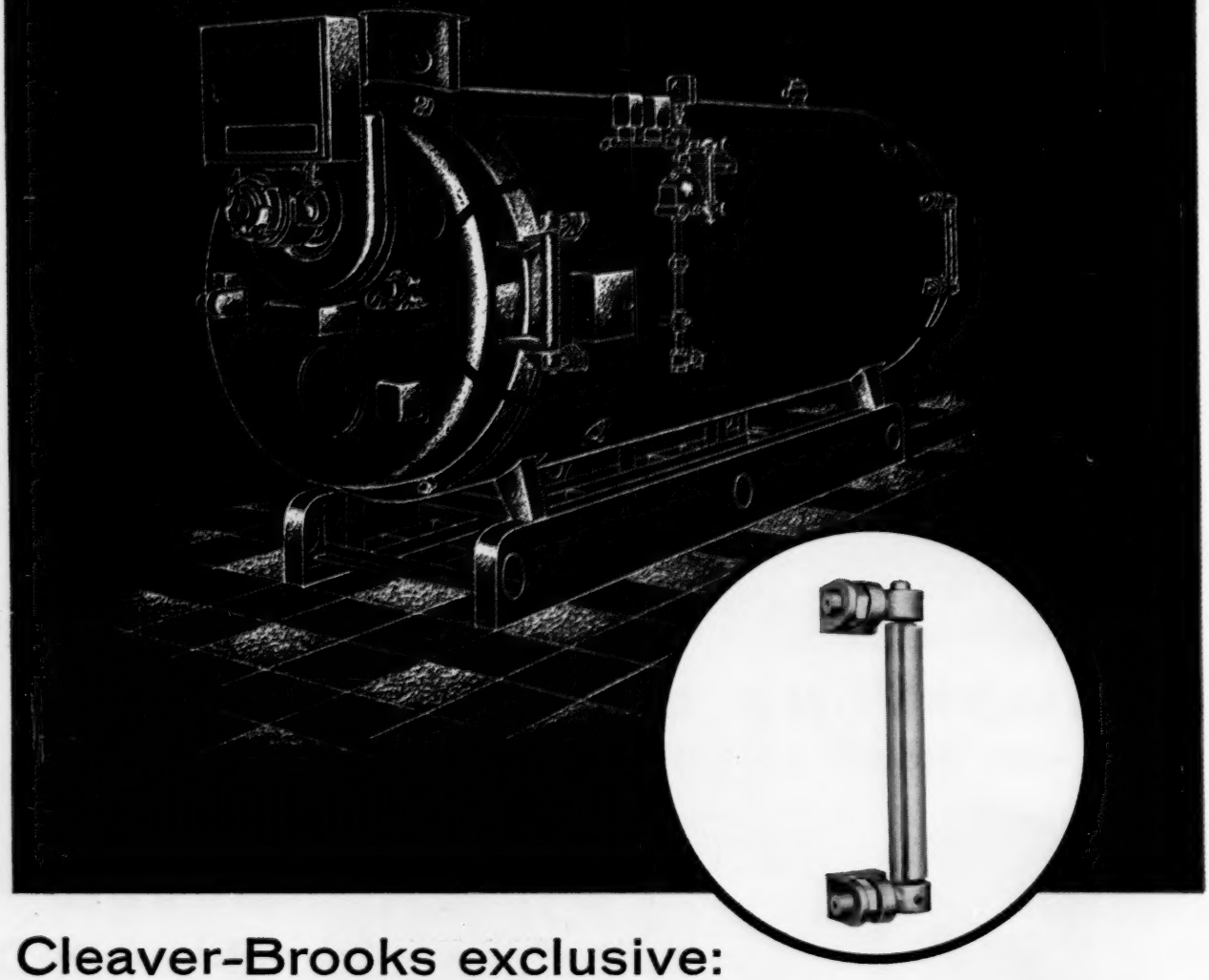

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Volume 58, Number 12 **December, 1961**

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COVER PHOTO: A technician at the Commonwealth Edison Company's Dresden nuclear power station lowers a fuel rack basket into a storage pool prior to loading it with uranium fuel. Operations at such a power station are radically different from those at a conventional power station, and ventilation techniques are one measure of these differences. This month's **Reference Section,** by Tony Kavale of Ebasco Services, tells why **ventilation for a nuclear power plant is variable and vital.** See page 61.

HIGH SPOTS in this issue

LEAD-OFF WITH LIGHT: This month's lead-off article describes the latest work on solution to the problem of excess cooling loads imposed by ever increasing lighting levels in modern office buildings. Murray Quin, Day-Brite Lighting research man, reports on a troffer under development that **promises to pull most of the heat away before it ever enters the space**—and to save that heat for useful chores elsewhere in the building. See page 51.

CONTROLS: The well-engineered layout for a radiant ceiling panel **must incorporate the necessary controls at the design stage.** With this theme, John Weast discusses control theory and application for heating-only and heating-cooling radiant ceiling panels. His article begins on page 54.

MORE TRICKLER: New York Blower's Chief Engineer adds another to his very popular series on fans with **"Check Propeller Fans for Industrial Ventilation",** page 57. Many engineers fail to appreciate their value in many applications, he points out. The article shows where and how to use them.

COILS ON HIGH: C. J. Trickler's "Fan Selection for Heat and Altitude" this past June has prompted Alan S. Decker, Dunham-Bush engineering vice-president to write "Coil Selection for Altitude", appearing this month on page 71. Two examples, fully worked out, show clearly **how to specify heating and cooling equipment for use at high elevations.**

TWO SPECIAL REPORTS: Included in this issue's News of the Month department are special reports on the meetings of **Consulting Engineers Council** and **Air-Conditioning and Refrigeration Institute.** Both engineers' and manufacturers' organizations are making considerable headway in solving the many problems that beset them.

The key to school air conditioning is in your hands...

Changing educational patterns demand flexible schools with learning spaces equipped for year-round air conditioning under unitary control— as an economic necessity based upon educational productivity for the life of the building.

New schools need air conditioning.
To produce the quality and quantity of education required in the future, school buildings must be free of the excess heat that shackles learning in many of the nation's classrooms from early spring to late fall.
School people know this; but some of them are inhibited by public opinion or by the notion that an air-conditioned school must be an inartistic box.
It is largely up to you to correct these impressions . . . by explaining how air conditioning eliminates the greatest physical threat to learning, and by showing how it frees school architecture from old clichés and permits you to meet the educational specifications with originality and economy.
As you know, a renaissance in school design is already under way, stimulated by the need for controlled environment schools— and Nesbitt *Year-Round* Unit Ventilators are being widely employed as the preferred equipment for all-season thermal comfort in every learning space.
Nesbitt can help you to explain the importance of school air conditioning with slide films. case studies, cost data, publications, and other services.

MORE LEARNING PER SCHOOL DOLLAR

Nesbitt AIR CONDITIONING FOR SCHOOLS

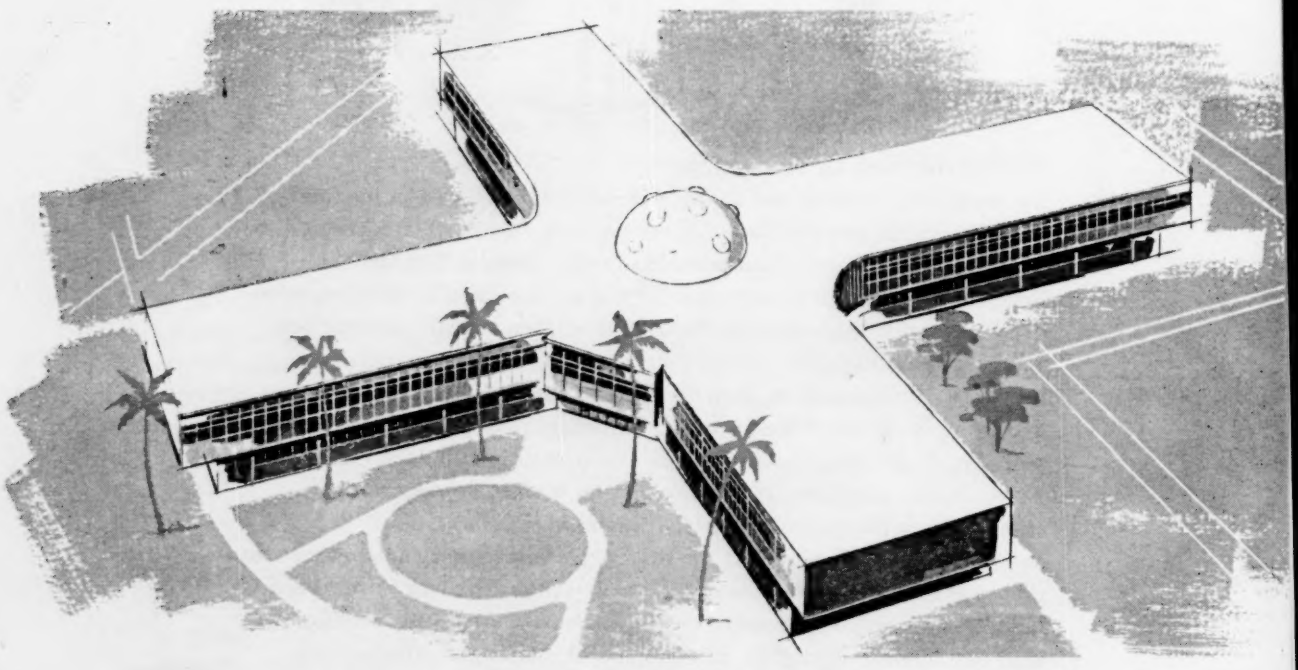
BASIC INGREDIENT Excellence Nesbitt Heating Ventilating Air Conditioning

Year-Round Unit Ventilator and Storage Cabinets • Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.

HOW TO SAVE ON HEATING AND COOLING BY MAKING EVERY B.T.U. COUNT...

Recirculating internal zone heat to external zones not only maintains temperature balance at equal load conditions, but results in definite dollar savings at the State of Florida Office Building in Winter Park. It is an innovation born of the necessity to create a low-cost air conditioning system for a building where each side of its four wings is exposed to maximum sun load at some time during the day. The result is a much greater cooling than heating load.

Faced with this, Consulting Engineer James Gay put his "imagineering" to work and combined it with some practical economics. Knowing that well water was conveniently available, he decided to put it to work. He did this by installing a heat pump. Around the heat pump he installed a Powers control system which senses equal load conditions within any of the wings. As this occurs, the normally rejected heat is pumped from the interior zones to provide heating for the exterior zones.



Reprints describing the flexibility of other Powers systems in commercial buildings, schools, and hospitals are available without obligation. Request them for your idea file. If you have an immediate or near future requirement, call your local Powers representative or contact our home office.

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Orlando, Florida

Consulting Engineer:
James L. Gay,
Orlando, Florida

Mechanical Contractor:
Henley & Beckwith,
Jacksonville, Florida

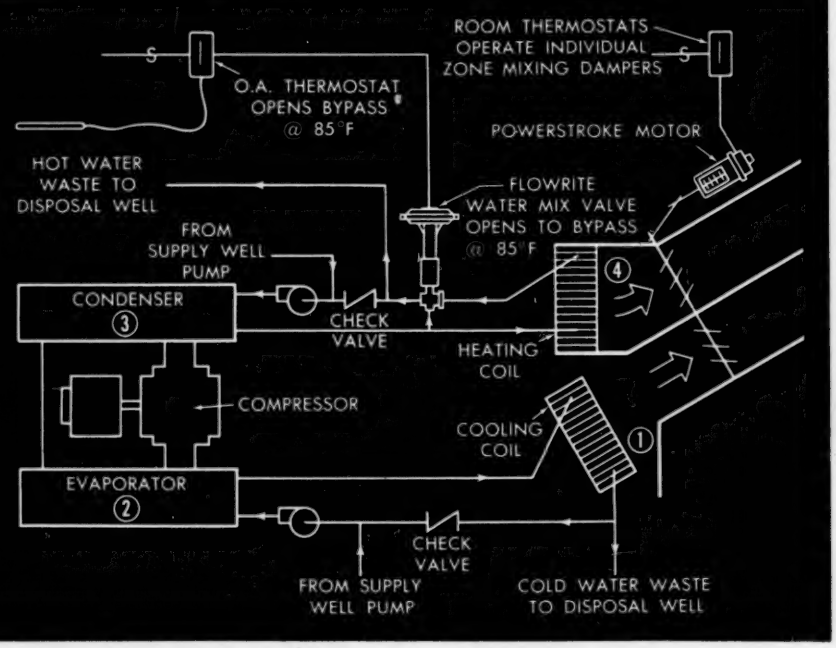
Architect
Hugo R. Broleman, Jr.
and
Consulting Engineer
James L. Gay

① *Heat is extracted from air passing to external zones' cooling coil.*

② *Heat is exchanged to the refrigerant in the evaporator.*

③ *Condenser exchanges the refrigerant heat to the hot water supply.*

④ *Hot deck coil transfers this heat to the interior zones' incoming air.*



The Powers Regulator Company offers an extended line of control systems: Powers-Grover Pneumatic Tube Systems and Powers Security Alarm Systems. Request literature and recommendations on your requirements.

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CONTROL SYSTEMS SINCE 1891

NEWS OF THE MONTH

CONSULTING ENGINEERS COUNCIL MEETS

Adopts CEC File Number for Technical Literature; Told to Act on International, Community Projects

THE AVOWED "GET-THINGS-DONE" REPUTATION of the Consulting Engineers Council was once again in evidence during the week of November 1-4 as representatives of America's 33 state and regional Associations of Consulting Engineers concluded that organization's Semi-Annual Convention in Miami Beach, Fla.

Among the "things done" at the Florida Convention were: Adoption of an indexing system for engineer use in filing manufacturers' technical data and catalogs; . . . approval of new CEC Mechanical-Electrical Special Conditions of the Contract; . . . clearance to proceed with a professional insurance program for consulting engineers, . . . reiteration of the Council's opposition to competitive bidding, . . . and an invitation to President Kennedy to make wide use of consulting engineers in the Government's fallout shelter survey program.

Delegates and observers at the Florida Convention were particularly cheered by reports of CEC progress in its campaign to halt Federal encroachment of the private engineering field. One indication of such progress was an appeal by Robert L. Moorman, Chief Engineer for the Development Loan Fund, for the names of consulting firms, interested in international work. According to Moorman, the new Agency for International Development is planning, where possible, to contract with private enterprise, including consulting engineers.

A similar call was issued by U.S. Chamber of Commerce President Richard Wagner who urged consultants "to assume the front ranks of all community betterment programs," and to "oppose intervention of federal authority which seeks to dictate solutions to local improvement problems."

The Chamber President, who was the principal speaker at the Engineers Council semi-annual banquet noted that "Consulting Engineers particularly suffer from federal competition. Federal agencies build big staffs of their own engineers, while tax money foots the bill, and soon find it is no longer necessary to farm out business to privately-owned consulting firms." Wagner advocated that engineers, as well as all private citizens, recapture the "do-it-yourself tradition" and "bar the doors of city hall to Uncle Sam."

Technical Literature

In what was described by Council President Harold P. King, of Los Angeles, as an "achievement of monumental proportions," Council Directors OK'd for publication a standardized, indexing system for member use in categorizing the reams of technical brochures and catalogs distributed by equipment manufacturers. The new system, which is divided into four major sections, was developed under the direction of a special task force committee chairmanned by Robert W. LaTour, of Bosch and LaTour Consulting Engineers, Cincinnati.

It is the hope of the consultants that their system will, after an appropriate trial period, be accepted by U. S. manufacturers to the extent that the CEC file numbers will be published on technical literature in much the same way AIA file numbers are now published on such material.

Contract Documents

CEC's library of contract and specification documents picked up a valuable new addition with announcement by Documents Committee Chairman Art V. Maxwell, Salt Lake City, of the publication of new Special Mechanical-Electrical Conditions for use of consultants in interprofessional practice. In presenting the new document, Maxwell also took note of increased acceptance of all Consulting Engineers Council specification documents, citing in particular the fact that CEC's Springfield, Ill., office is currently filling orders for 12 to 15 hundred copies of the General Conditions of Contract per month.

Professional Insurance

On the matter of insurance, the consulting engineer group approved, for release, a comprehensive report by Professional Insurance Committee Chairman Lester Bosch of Cincinnati. Also cleared for distribution was the EJC "Architect-Engineer Legal Responsibilities" report by John R. Clark, of Philadelphia.

John Williams, consulting engineer from Washington, D. C., pointed out that insurance does not answer all the questions in the matter of unjust claims. As a result of Williams' comments, the Council will look into the matter of retaining an outstanding legal firm to vigorously study and defend against precedent-setting insurance claims. Such a firm, it was envisioned, would work with, and assist, local attorneys on liability cases.

(Continued on page 10)

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Unequalled Quality

Your Best Buy

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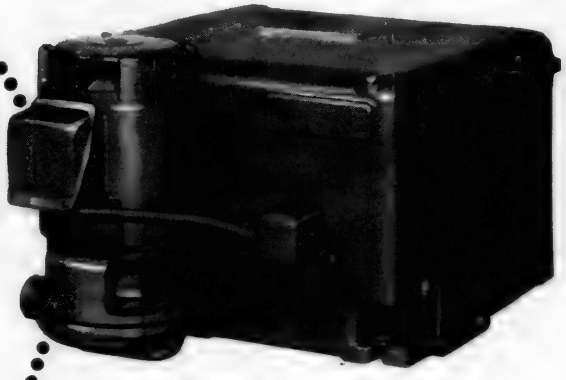

Single and Duplex Units

Capacities through 150,000 sq. ft. E.D.R.

Featuring compact, Centrifugal Pump Design

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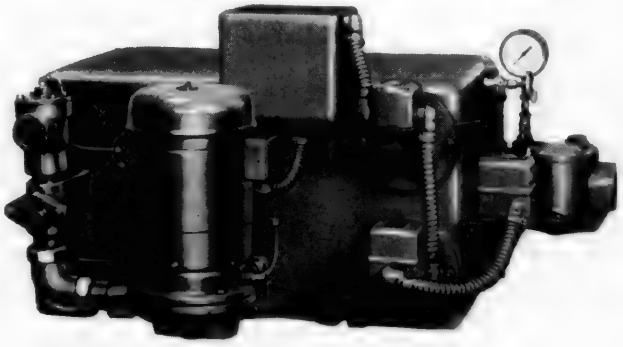

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Featuring Hoffman Jet Vacuum Producer

Thousands of industrial and commercial steam systems use Hoffman Centrifugal Type Pumps year after year for rapid, low-cost removal of condensate and air from steam lines, and return of condensate to the boiler. Efficient Hoffman Pumps, with all bronze fittings and cast iron receivers, are designed so that all parts subject to wear can be easily inspected, serviced or replaced without disturbing piping. For small systems, Hoffman's line of quality-engineered "Watchman" Condensation Pumps have ratings up to 12,000 sq. ft. E.D.R. Hoffman sales-engineers are available at all times for consultation.

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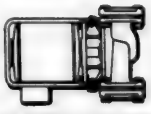
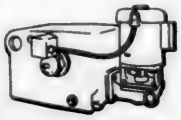

Hot Water Circulators

Float Valves


Condensation Pumps

Flow Control Valves

Zonal Valves

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CEC REPORT

(Continued from page 8)

At the present time, four companies are writing liability insurance coverage. They are: The Continental Casualty Company (endorsed by CEC), The Citizens Casualty Company of New York, The Travelers Indemnity Company, and Lloyds of London.

Another committee, the CEC Legal Committee, headed by George Heft, New Orleans, also recommended retention of a legal "clearing house" to handle such problems as: wage-hour rulings, state registration laws, violations in connection with competitive bidding, and architect-engineer responsibility.

External Relationships

Relations between engineers and manufacturers were reported at an all time high. CEC Vice President Cedric R. Acheson, Syracuse, noted that the Producers' Council is anxious to work with consultants in matters of education, technical seminars, indexes, and even "free" engineering. With regard to the latter, a resolution is being drafted to clarify the Council's attitude.

A particularly painful thorn in CEC's side—manufacturer use of the title "Consulting Engineer" to designate more eminent members of the engineering staffs—has reportedly been removed as a direct result of Council action. In a report to the convention, Rules of Practice Committee Chairman, Joe Williamson, of St. Louis, called attention to the fact that the Westinghouse Electric Corporation has dropped the title of "Consulting Engineer."

Inside CEC

Internally, the Consulting Engineers Council was reported as making tremendous strides. Retention of a Managing Director and transfer of the Headquarters Office to Washington, D. C., were announced by Council President King as "imminent." "Imminent" was later clarified to "before CEC's May, 1962, Annual Meeting in New Orleans." In the works is the possibility of a Consulting Engineers Council building to be built in Washington, D. C.

The Council's phenomenal growth record was maintained with the approval of a membership application submitted by the Arkansas Association of Consulting Engineers. Also announced was the establishment of an Ohio Association of Consulting Engineers. These groups bring to 34, the number of state or regional consulting Associations affiliated with the Council.

Shelter Survey

In a carefully-worded resolution, the CEC Board of Directors called upon President John F. Kennedy to utilize U. S. consulting engineers on the government's proposed, nationwide fallout shelter survey. Recommended was the use of registered professional consultants to "determine availability, adequacy and extent of structures which might serve as fallout shelters in the event of an atomic holocaust."

Commenting on the fallout-shelter action, Council President King urged all consultants "to also make yourselves available for service to public bodies concerned with the shelter-survey program." King noted that a Colorado consultant serves as an advisor to the Denver Better Business Bureau in controlling projects and the claims of package shelter promoters.

Competitive Bidding

While the problems of competitive bidding were covered in legal discussions, the subject also received considerable attention as an ethical matter. Reiterated was CEC's contention that it is unethical to submit a quotation for engineering services which is solicited by mail, or in any event, where there is reason to believe that other engineers are being requested to submit a quotation for the same services.

Site of the Convention was the Golden Gate Hotel, Miami Beach. Next meeting of the CEC Board of Directors will be May, 1962, in New Orleans.

SHOW VISITORS WANT LESS SEX, MORE TECH DATA

What do visitors want from exhibitors at an industrial exposition? Lots of products or concentration on a few? Pretty girls or technical displays? Friendly salesmen or engineers?

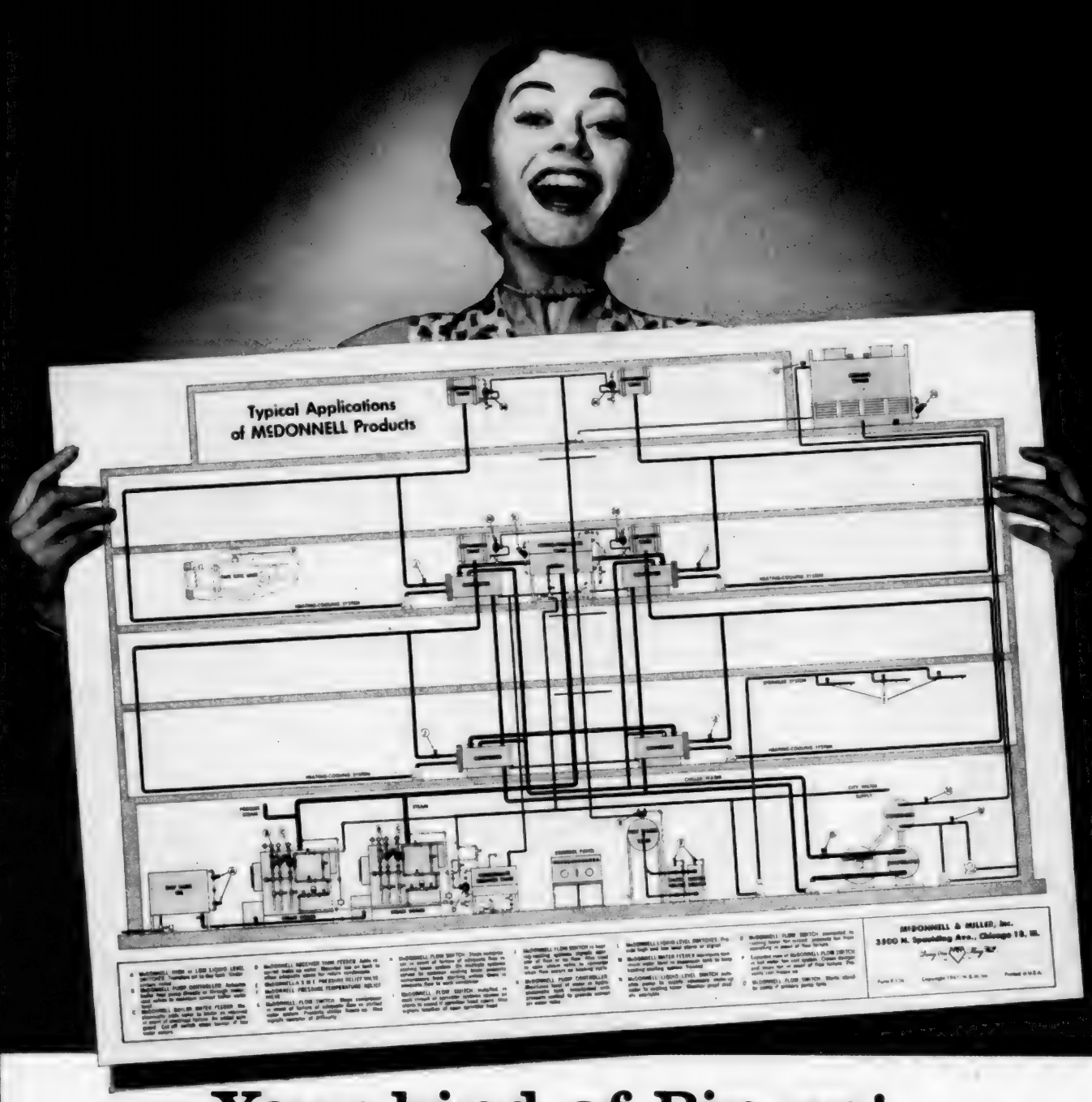
Results of an intensive study of visitors' desires and needs have been published by Clapp & Poliak, Inc., New York, producers of many of the nation's largest industrial shows.

Nine major areas for improvement were indicated in the visitors' responses and they are summarized in the publication, "What They Want," with a typical and frequently repeated comment in each case and a recommendation for improvement. Single copies are available without charge from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

The survey was conducted at the Design Engineering Show held at Cobo Hall earlier this year. A foreword to the survey points out that visitors were found very knowledgeable about the improvements they want and in overwhelming agreement on the major points. With great unanimity and consistency they know what they want.

The nine major requests of visitors were: (1) Technically qualified booth personnel; (2) alert and well trained people; (3) less high pressure selling; (4) fewer pretty girls; (5) maximum number of products and their features; (6) more product application; (7) better technical literature; (8) the newest products and research and development activities; (9) exhibits that are both easy to study and that are readily understandable.

(More news on page 14)



Your kind of Pin-up!

It shows where and why you use McDonnell products

Here is a wall chart that does an excellent job of pointing out the application of McDonnell controls in a typical commercial building.

It's yours for the asking. The gal isn't included; her only purpose is to show you that it is a big, three-foot-wide, easy-to-read chart, printed in four colors to illustrate the applications on boilers, tanks, heaters, chillers, fan coils, cooling towers and other equipment.

Uses of major McDonnell products are shown and described: boiler water feeders, pump controllers, tank feeders, relief valves, liquid level switches, and flow switches.

Unless we're both lucky you won't find all of these uses in any one building. But you'll find many of them—probably more than you'd think—in most buildings. Just mail the coupon to receive your chart by return mail.

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3500 N. Spaulding Ave., Chicago 18, Illinois

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Boiler Water Feeders • Low Water Fuel Cut-Offs • Pump Controllers • Relief Valves • Flow Switches • Liquid Level Controls for Tanks, Stills, Air Conditioning Systems

Coupon Brings it! (Chart F-1060)

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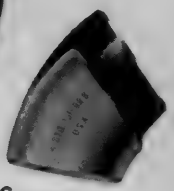
By_____

Mail to: McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Illinois.

Now

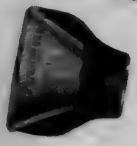
Compact 90° Elbow versus conventional long radius elbow*



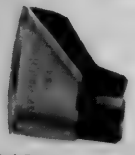
Compact 45° Elbow versus conventional 45° elbow†

Compact Straight Tee versus conventional

Compact Reducing Tee versus conventional



Compact Concentric Reducer versus conventional



Compact Eccentric Reducer versus conventional

Compact Welding Cap versus conventional

Note these actual photos showing dimensional differences between Compact Fittings and corresponding conventional fittings.

*The Compact 90° elbow is contrasted with a conventional long radius elbow which is by far the most commonly used type. Of course the dimensions of the Compact 90° elbow are the same as those of regular short radius Taylor Forge WeldELLS.

†The 45° conventional elbow has heretofore been obtainable only in the long radius pattern shown in the comparison.

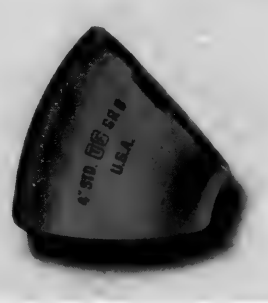
Photograph shows a test that has proved the rugged strength of Compact Line Fittings. The test unit was fabricated from 4" and 6" Standard Thickness (Schedule 40) Grade B pipe and includes a 6" x 6" x 6" Tee, a 6" 90° Elbow, a 6" 45° Elbow and a 6" x 4" Concentric Reducer.

In testing, a mean pressure of 875 psig (five times WOG rating) was established as basic pressure. Cyclic pressure variation was from 50% under to 50% over this pressure—in other words, from 437 psig to 1312 psig. The assembly was then subjected to 36,500 of these pressure cycles—the equivalent of one cycle per day for *100 years!*

Upon completion of the cyclic testing, the unit was hydrostatically burst, the break occurring, as it theoretically should, in the crotch of the tee and extending into the adjacent run and branch pipes. Moreover, the unit had to be brought to a pressure of 5200 psig before bursting, yet the theoretical bursting pressure of 6" pipe is only 5080 psig. After 36,500 pressure cycles this result is rather startling.

90° ELBOWS

45° ELBOWS



STRAIGHT TEES

it's the New TAYLOR FORGE

there IS a way

to cut heating | cooling piping costs and still have a piping job you can be proud of

Yes, the new Taylor Forge Compact Line of welding fittings really does reduce piping costs. First, because the simplified designs and reduced dimensions permit major manufacturing economies. Second, because all other incidental costs—shipping, storage, trucking, on-the-job handling—are also less than with conventional fittings.

Take the 4" size for example: A "set" of Compact Fittings consisting of a 90° and 45° elbow, straight tee, cap, 4" x 2" tee, 4" x 2" concentric reducer and 4" x 2" eccentric reducer exactly as illustrated here, weighs little more than half as much as corresponding conventional fittings. And remember, this weight savings is purely the result of designing and dimensioning functionally for economy.

Taylor Forge Compact Line Fittings give you a piping job you can be proud of, too. Proud of its trim functional appearance. Proud of its rugged strength and complete dependability—well supported by the test described on the opposite page.

Compact Line Fittings are of seamless construction using Grade B carbon steel. The line includes 90° and 45° elbows, straight and reducing tees, concentric and eccentric reducers and caps in sizes 2", 2½", 3", 4", 5" and 6"; reducing tees and reducers in intermediate iron pipe sizes down to one-half of the nominal run or large end size. They are manufactured to the same high standards as other Taylor Forge products for piping and pressure vessel construction. All have complete stamped-in identification markings as shown. For protection, identification, and pleasing appearance, they are painted orange with non-toxic corrosion resistant paint.

American-made Welding Fittings

Designed and manufactured for utmost economy. No frills; just the solid value you would expect from TAYLOR FORGE.

TRADITIONALLY DEPENDABLE

Compact line fittings are carried in stock by Taylor Forge Distributors in all important trading centers. The whole story is in Bulletin 619. *Ask for it.*

Taylor Forge & Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois

Plants: Carnegie, Pa.; Somerville, N.J.; Gary, Ind.; Houston, Texas; Fontana, Calif.; Hamilton, Ont., Canada

District Sales Offices: New York, Philadelphia, Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles, San Francisco, Seattle, Hamilton, Calgary, Montreal

REDUCING TEES

CONCENTRIC REDUCERS

ECCENTRIC REDUCERS

WELDING CAPS

COMPACT LINE of Welding Fittings

Officers of ARI at the Annual Meeting in Hot Springs, Va., are, left to right, John W. Norris, president, Lennox Industries, Inc., Byron E. James, president, McQuay, Incorporated, and L. N. Hunter, director of engineering, Plumbing-Heating-Air Conditioning Group, Crane Co., vice-presidents; Russel Gray, president, Carrier Air Conditioning Company, president; Joseph B. Elliott, president, York Div., Borg-Warner Corp., vice-president; and W. A. Aubrey, president, Frick Company, treasurer. Vice-presidents not present were Thomas Hancock, executive vice-president, The Trane Co., and F. J. Kreissl, president, American-Standard Controls Division.

ARI ANNUAL MEETING

Marks Progress Toward Industry-Wide ACHV Manufacturers Association

The Annual Meeting of Air Conditioning and Refrigeration Institute (ARI) at The Homestead, Hot Springs, Va., No. 12-15, reflected progress toward consolidation of the air conditioning industry under one roof, and the maturing of a vehicle through which its manufacturers are addressing themselves to their problems occurring on a national scale.

New Product Section

Incorporation of a new Product Section, Non-Residential Warm Air Heaters, into ARI was one of the more outstanding achievements during his tenure of office reported by outgoing president R. K. Serfass of Westinghouse. Incoming president Russel Gray of Carrier pledged his administration to a continuing effort toward consolidation with other associations in the industry, pointing out that an air-conditioning, by definition, includes both heating and ventilating.

In his talk at a luncheon session, Maurice H. (Bud) Stern of Lennox Industries showed how ARI, through its product sections, is able to maintain a unity of the whole while providing the flexibility to handle the special problems of its sub-industry sections, among which one finds sections on liquid chilling packages; unitary air conditioners; and valves, driers, fittings and accessories, to name a few.

Mr. Stern said that his (warm air) group had been induced to join ARI because they could organize a separate and independent

(Continued on page 16)

ARI Fan-Coil Certification Program Becomes Operative Next October

An industry certification program for room fan-coil air-conditioners is scheduled to become operative in October 1962.

Sponsors of the program are the Air-Conditioning and Refrigeration Institute, Air Moving and Conditioning Association, Inc., and the Institute of Boiler and Radiator Manufacturers. Both of the latter organizations cooperated with ARI in development of the new industry standard for room fan-coil air-conditioners which provides the basis for the program.

The new standard, designated "Industry Standard 441," and the program have been accepted by the industry through the efforts of the Fan-Coil Coordinating Committee, representing manufacturers of this type of equipment from the memberships of the three sponsors.

Participants in the program need not be members of any of the three sponsoring organizations to obtain approved standard ratings for their products. The program requires that a license agreement be executed between the manufacturer and ARI, which specifies the conditions of participation and authorizes publication of approved standard ratings and display of the certification symbol by the licensee when the conditions of participation have been satisfied. Both cooling and heating capacity ratings are to be expressed in Btu per hour, similar to ARI's unitary air conditioner program.

Participation in this program requires, in addition to the manufacturer's own testing of his product prior to certification, precertification check testing at an independent laboratory of equipment proposed for certification.

For complete plant heating you need both...

WING

STEAM, HOT WATER OR HIGH TEMPERATURE HOT WATER*

REVOLVING and DOOR HEATERS

Wing Revolving Discharge Heaters give you:

Uniform heating . . . Warm air is distributed widely and evenly in a gentle flow—no hot blasts or cold areas — heat moves over and around obstacles.

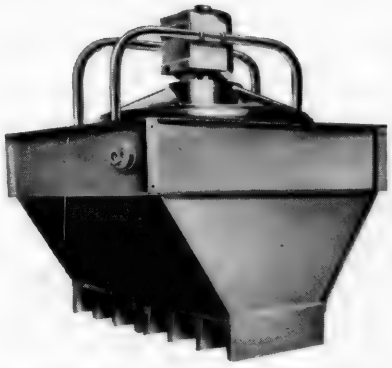
Big area coverage . . . Perfect heating coverage from mounting heights as low as 8′ and high as 65′—areas up to 144′ x 144′ can be covered by a single heater.

No heat stratification . . . All the heat paid for is used — truss area heat is recirculated to the working level — low temperature differentials are maintained.

Low installation cost . . . Fewer Wing Revolving Heaters are required to supply most plant heating needs — you save on wiring, piping and installation labor costs.

Simplified maintenance . . . Tubes are mechanically connected to headers. Individual tubes can be removed or replaced on the job — unnecessary to replace entire heater section.

WRITE FOR BULLETIN HR-6A



Wing Door Heaters give you:

Improved worker comfort and efficiency . . . Large shipping doors are blanketed with high velocity streams of warm air whenever they are opened in cold weather. Incoming cold air is effectively tempered. Nearby workers remain comfortable. Production stays normal. Draft caused illnesses are minimized.

Stabilized plant temperatures . . . The spreading of cold air through large plant areas is avoided even where negative pressures caused by exhaust systems prevail.

Low operating costs . . . Uses steam only when doors are open.

Wide range of sizes . . . Ten sizes are available to suit rolling, overhead or other types of industrial doors. The largest provides protection against outside temperatures as low as −20° F.

Wing Door Heaters can be supplied with Vari-Jet discharge. Automatically converts to perimeter or space heater when doors close.

WRITE FOR BULLETIN DH-2B

**Gas-fired models also are available*

WC-165

WING

L. J. WING MFG. CO.
DIVISION OF AERO-FLOW DYNAMICS, INC.
LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA
IN EUROPE: WANSON, HAREN-NORD, BRUSSELS, BELGIUM

ARI REPORT

(Continued from page 14)

product section where its problems would be considered of primary importance, plan its own program, adopt its own budget, create its own certification program, yet have access to the highly qualified ARI staff for assistance in dealing with its problems and in dealings with the government.

Mr. Stern also suggested that, as many new products within the industry develop, new sections would be formed. He considered that the manufacturers of packaged heating and cooling units designed for outdoor installation would also greatly benefit from such organization.

"Outsiders" Speak

A unique feature of this year's Annual Meeting was the inclusion, among the dinner speakers, of men from outside the industry. Donald I. Rogers, business and financial editor of The New York *Herald Tribune* helped to relate the problems of ARI members, as manufacturers, with the larger question of the fate of the free enterprise system. Maj. Gen. W. Austin Davis, USAF, showed how vital was the role of the controlled environment in the outer space program.

Two items in particular reflected the national scope of the problems to which ARI addresses itself. Reported was considerable work done on the question of the federal excise tax on packaged air conditioners designed for free air delivery. The legal, engineering, and administrative branches of the staff, as well as the membership of the Unitary Air Conditioners product section of ARI are working together to straighten out the inequitable and ambiguous situation created by the tax law and its interpretation by the Internal Revenue Service.

The other item, reported by Arthur Sworn Goldman of *House and Home*, was a mammoth sales promotion of year-round residential air conditioning in Wilmington, Del. Led by ARI members, air conditioning manufacturers, builders, and the banks cooperated in a drive that resulted in an unprecedented number of fully air conditioned new homes sold in the area. The techniques developed in Wilmington are being applied to many other areas of the country.

ASHRAE MEETING FEATURES FOUR TECHNICAL SESSIONS

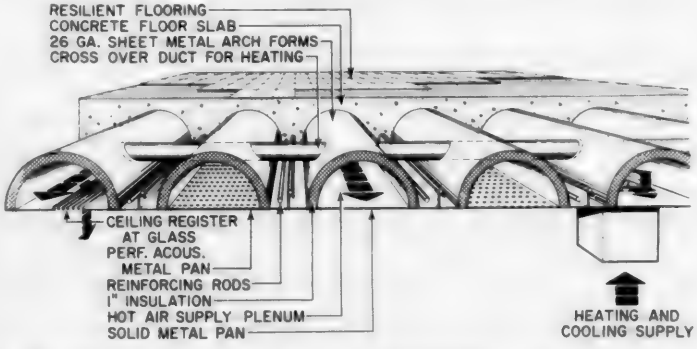
The semiannual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) will be held January 29-February 1, 1962, at the Chase-Park Plaza Hotel, St. Louis, Mo.

The program for the meeting will feature four technical sessions on refrigeration, air filters, heating and heat transfer; seven symposiums; and six forums. Among the 16 papers to be presented at the technical sessions will be these: The Operating Economy of Air-Cooled Refrigerant Condensing; Cross-Flow Cooling Tower Analysis and Design; Operating Principles of Non-Ionizing Electrostatic Air Filters; Controlled Atmosphere Apple Storage; Solar Heat Gains Through Plain, Coated, and Laminated Flat Window Glass; Energy Sources and Requirements for Residential Heating; An Instrument for the Measurement of the Humidity of Air; and Heat and Mass Transfer in Dehumidifying Surface Coils.

The symposiums will cover industrial ventilation; domestic refrigerator engineering; steel boiler ratings; food storage; combined heating and air cooling systems; and room air conditioners.

George W. F. Myers, head of Myers Engineering Equipment Co., St. Louis, and a member of ASHRAE's St. Louis Chapter, is general chairman of the host committee, assisted by Chapter members, ASHRAE officers and staff.

BUILDING SYSTEMS CUT COSTS ON RESIDENTIAL CONSTRUCTION



The floor system developed in the Armco-sponsored Koch research project is shown with its four basic functions: structural slab, sound barrier, finished ceiling and air distribution system.

New building components and structural systems that may cut residential construction costs as much as 10% and substantially reduce maintenance have been announced by Armco Steel Corporation, Middletown, Ohio.

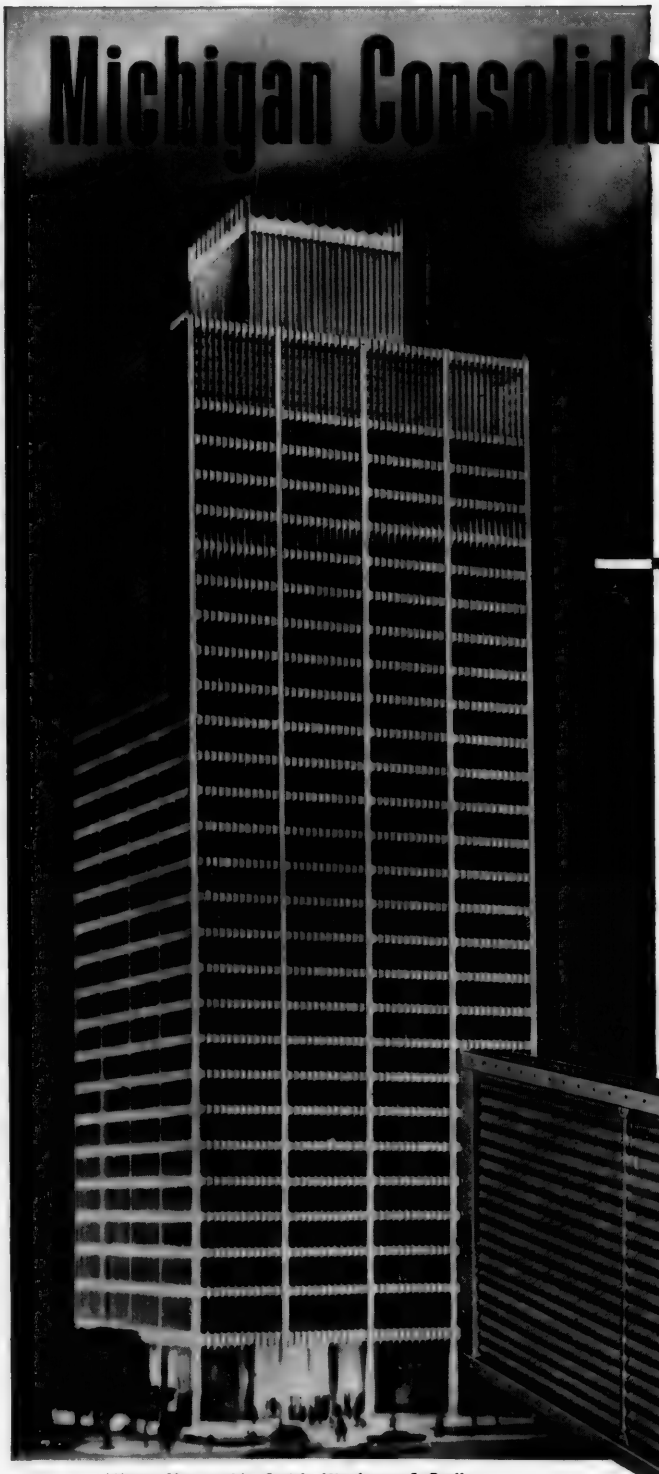
The new developments are results of an Armco-sponsored research study by Carl Koch & Associates, Cambridge, Mass., a

(Continued on page 130)

Michigan Consolidated Gas Company

DETROIT, MICHIGAN

New Forms and Systems Achieve Striking Effect of Soaring Grace



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Associated Architects and Engineers

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Mechanical Contractors

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to temper the air delivered to the unique new variable volume reheat window units.

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space. Where desired, it also permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.

Aerofin hot-water heating coils (illustrated) and chilled-water cooling coils contribute to the year-round comfort of this outstanding new building.

AEROFIN CORPORATION 101 Greenway Ave., Syracuse 3, N. Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES

What Readers Say:

Guide to Hospital Plumbing

EDITOR, AIR CONDITIONING, HEATING AND VENTILATING:

I would like to compliment Lawrence Guss for his most complete "Guide to Hospital Plumbing" appearing in the October, 1961, Reference Section of Air Conditioning, Heating and Ventilating.

I have been a member of American Society of Sanitary Engineering, an organization contributing its efforts to promote good practices for health and humanity, and I feel this wonderful article by Mr. Guss will certainly help those of us that have read it and have taken it out and filed it, to establish a basis for specification.

May I state, local ordinances or not, Mr. Guss' most complete presentation is a specification in itself; all pipe sizing, vents, flow rates, etc., are good practice, and it should be considered as an operational specification or ordinance, rather than be regulated or controlled by local ordinances except, perhaps, where a fresh water supply condition may exist, requiring roof water storage and supply sources, which can be best covered by local architects and engineers.

Conclusion: If we can get everyone that is interested in hospital or clinic construction and operation, maintenance, supervising and purchasing to study Mr. Guss' "set-up" and follow it, or its intent, we will be doing much for the betterment of humanity.

Rudy F. Klein Jr.

San Antonio, Texas

EDITOR, AIR CONDITIONING, HEATING AND VENTILATING:

This is to request, if possible, that you send us approximately 50 copies of a reprint of "A Guide to Hospital Plumbing" by Mr. Lawrence Guss which appears in the October, 1961, issue of your magazine. We would like to have these available for distribution to architects and engineers designing hospitals in the State of Georgia.

John G. Wilkins, Jr.

Hospital Construction Engineer
Hospital Services
Department of Public Health
Atlanta, Georgia

The Annual Index to Air Conditioning, Heating and Ventilating for 1961 will appear in the next issue (January, 1962).

How Empire State Building and American Airlines solved vital fire protection problems with EVERLASTING VALVES

102 stories, 1,472 feet high, 16,000 tenants and 35,000 visitors sum up the fire protection problem of the Empire State Building. An in-building fire protection system is necessary to an unfailing water supply.

American Airlines loading bridge, shown below, gives passengers positive protection against fire with a unique deluge system.

Both these fire protection systems depend on Everlasting Pendulum Stop Valves, which have been installed in thousands of critical fire protection systems over the past 35 years.

For complete information on the unique American Airlines and Empire State Building systems, write for bulletins F. They include an editorial description of both these installations and a bulletin describing Everlasting's positive action pendulum stop valves.

Everlasting also makes a line of quick-opening valves for general service, boiler blow-off, and handling viscous materials, as well as a line of cylinder-operated valves. Bulletins on all these valves are available. **Everlasting Valve Company, 75 Fisk Street, Jersey City 5, New Jersey.**

EV 410

Exclusive hermetic design of assures dependable, economical

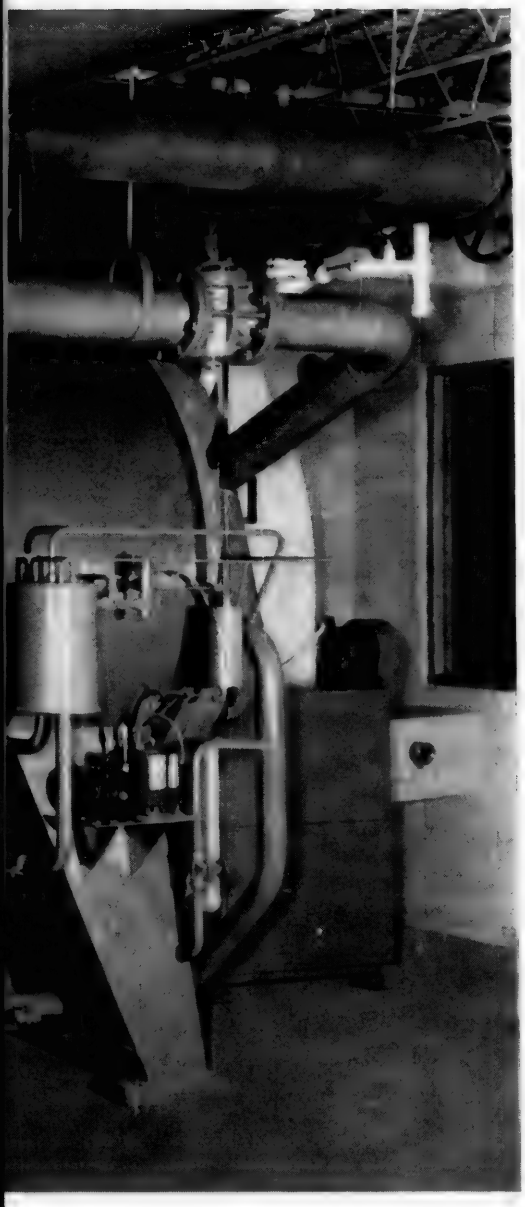
Another hospital air conditioned by TRANE: **Mt. Carmel Mercy Hospital, Detroit, Michigan, air conditioning system features a TRANE Absorption Cold Generator using low cost steam**

This 554-bed hospital received its first patient 23 years ago—in 1938. Since that time, five major additions and a continuous remodeling program have kept Mt. Carmel Mercy Hospital one of the most modern and efficient large hospitals in the United States.

The TRANE Absorption Cold Generator is located in the penthouse of the latest addition. It draws steam from an adjacent power house, and it chills water used to air condition the cafeteria, kitchen, dining room, executive offices and the children's playroom.

Because the unit does not require a full-time attendant, hospital administrators found they could free an operator for other maintenance work.

Trane Absorption Water Chiller operation and longer life



Long equipment life, superior reliability with low operating costs, minimum maintenance! The reasons more and more engineers specify TRANE Absorption Cold Generators.

Superior reliability, longer life

The exclusive hermetic design of TRANE Absorption Cold Generators assures much longer life than you can expect with water chillers having solution pumps with shaft seals. Air is prevented from entering the system where it could cause loss of capacity, increase in steam consumption, crystallization and deterioration.

All TRANE units are assembled at the factory. All refrigerant and solution piping is welded at the factory. No field welding is necessary—so every TRANE Absorption Cold Generator can be tested for air leaks before shipment with superior laboratory-type equipment. TRANE tests each unit with a helium mass spectrometer that is 10,000 times as sensitive as the best electronic leak detection equipment.

The TRANE Absorption Cold Generator—unlike other absorption machines—tends to free itself if crystallization is caused by temporarily abnormal conditions, such as power failure. Here's an actual case of how quickly and effectively this exclusive TRANE feature works: When a hurricane struck Charleston, South Carolina, there was a power failure. Within 30 minutes after power was restored a TRANE Absorption Cold Generator located in one of Charleston's largest motels, returned to normal operation. Other machines require a stand-by power source to eliminate costly crystallization damage.

Low operating and maintenance costs

TRANE Absorption Cold Generators operate efficiently down to 10% of capacity. And because these units are fully automatic in operation, a full-time attendant is not required.

TRANE Absorption Cold Generators have hermetic pumps that are automatically cooled and lubricated. The frequent and costly maintenance required by open-type pumps and complicated purge systems is avoided. There is no need for frequent seal replacements which involve draining the solution from the unit, re-evacuation, and recharging before operation can be resumed.

Wide selection is another reason why engineers specify TRANE. The TRANE Absorption Cold Generator is available in capacities ranging from 100 to 530 tons. There are twelve basic sizes for wide selection flexibility in the 100 to 530 ton range.

These are the reasons why throughout the country more and more engineers are specifying TRANE *Absorption equipment for low cost cooling of offices, hotels, motels, hospitals and factories.*

WANT MORE FACTS? . . .

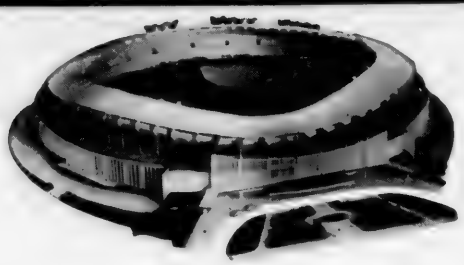
Check your nearby TRANE Sales Office for more information on the TRANE Absorption Cold Generator — and for a list of installations in your area. Or write direct to TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

Manufacturing engineers of air conditioning, heating, ventilating and heat transfer equipment

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED TORONTO • 101 U.S. AND 20 CANADIAN OFFICES



Circular stadium is full of angles

. . . and Bethlehem Steel Pipe was "rolled" through dozens of them

From start to finish, the new District of Columbia Stadium in Washington was built to please the customers. From the radiant-heated seating section alongside the field, to the cantilevered roof sheltering most of the 50,000 column-free seats, spectator comfort was the designer's aim.

28 water fountains are located around the stadium. Food and drink concessions—each with its own sink and drain—occupy some 800 linear ft along the walkways. And the 45 public rest rooms are equipped with an average of over 20 fixtures each.

A unique piping challenge

Piping the stadium was a job unlike any other. To start off with, the stadium is round, like the plan view of a doughnut with a 700-ft OD. It was built in 66 sections, each resembling a 5-level, truncated "pie"-shape with its side lines radiating from a point in the middle of the playing field. The upper levels are cut through by 66 huge, sloping cantilever beams, joined together with great box struts and wide-flange beams. Because of the undulating roof line, the position of this steelwork changes from section to section. This, plus the variously located services, required that the piping be laid out individually for almost every level of every section.

"Roll 74°"

As a result, very little straight-line piping was possible. And the common elbows were all-too-often inadequate to handle the odd angles required. "Rolling" the pipe around obstructions, using combinations of the rare 11¼° and 22½° fittings, became the rule rather than the exception. Almost every field sketch (there were hundreds) bore several notations, such as "roll 74°", or "roll 28°."

250 tons of steel pipe

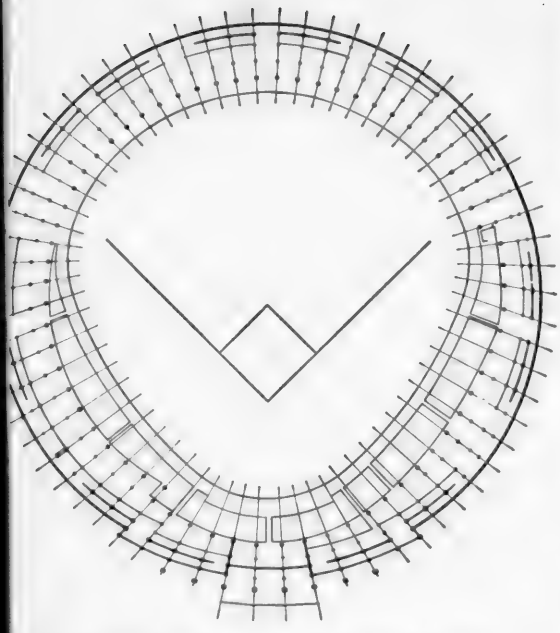
The project includes thousands of feet of storm drainage lines, water supply lines, sanitary vents and waste lines, and lines supplying the heating and air-conditioning system. In all, over 61,000 ft of Bethlehem black and galvanized steel pipe were used, ranging in size from 1¼ in. in continuous buttweld, to 12 in. in electric resistance-weld.

Bethlehem 6-in. pipe "rolls" along under the ceiling—with the help of two 11½° fittings. The job required about one ft of steel hanger rod for every three ft of steel pipe. Some 18,500 ft in all.

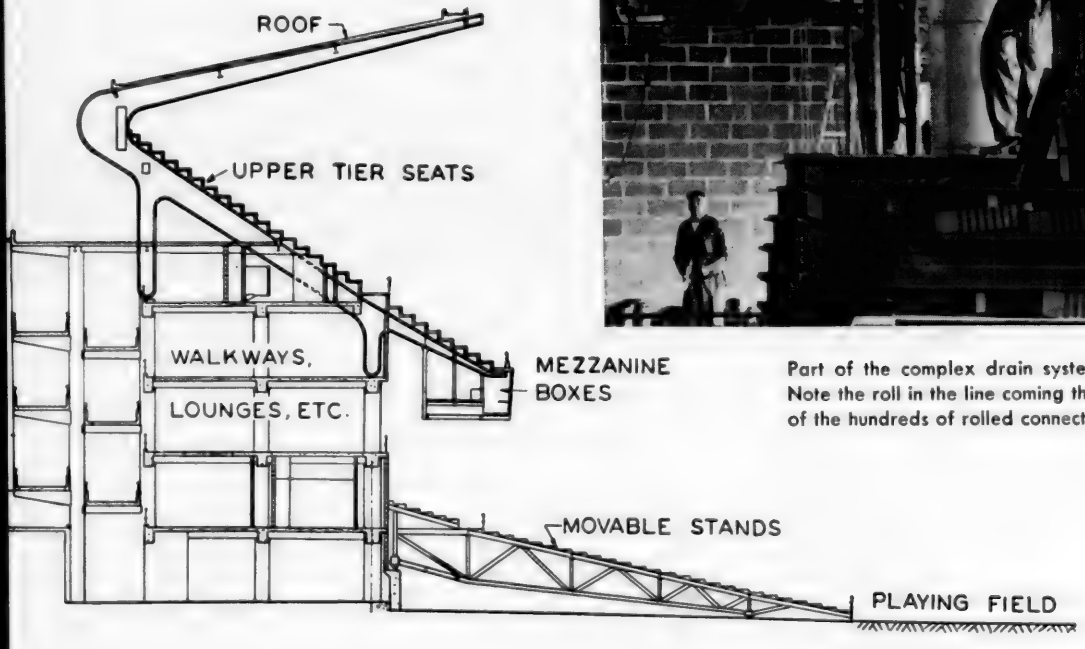
Owner: District of Columbia Armory Board
Architects and Engineers: Dahl-Erwin-Osborn
General Contractor: McCloskey & Co.
H, P, & AC Contractor: Lloyd E. Mitchell, Inc.
Pipe Distributor: Sanitary Supply Company, Inc.

Insist on Steel Pipe Made in U.S.A.

BETHLEHEM STEEL



These simplified plan and section drawings clarify the stadium's novel design—and the problems which confronted the service contractors. Structurally, only 28 of the 66 sections, and no two of the six levels, are similar. Many of the services' layouts could be determined only at the job site.



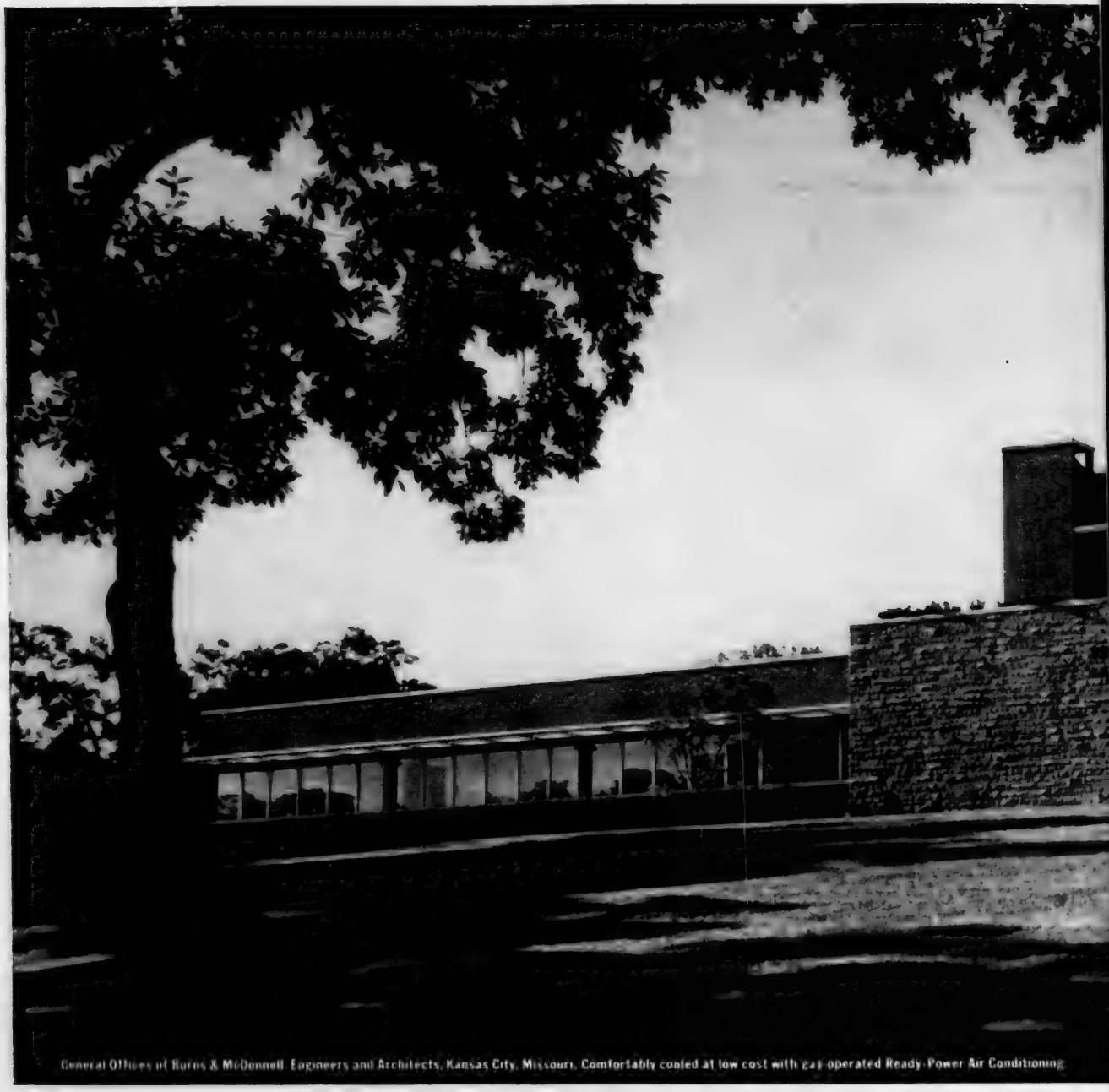
Part of the complex drain system on the fourth level. Note the roll in the line coming through the ceiling—one of the hundreds of rolled connections necessary.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Steel

. . . for Strength
. . . Economy
. . . Versatility



General Offices of Burns & McDonnell, Engineers and Architects, Kansas City, Missouri. Comfortably cooled at low cost with gas-operated Ready-Power Air Conditioning.

GAS-operated READY-POWER air conditioning

In office buildings, clubs, churches, theatres, bowling alleys, stores, factories . . . for every type of commercial and industrial air conditioning application . . . gas-operated Ready-Power units condition air with extremely low input per ton-hour.

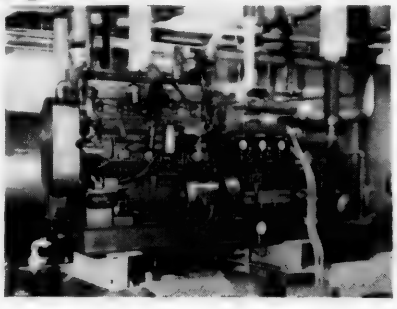
All Ready-Power Air Conditioning units average less than 13 cubic feet of natural gas per ton per hour. What's more, the total operating cost of these units amounts to *less than one cent per ton per hour.*

What makes this possible? Ready-Power air conditioning combines the unmatched fuel economy of gas with a unique variable speed

costs less than one cent per ton-hour!

operation. LOADMATCH CONTROLS automatically adjust output and fuel consumption to actual cooling requirements. Cooling is constant, as opposed to the ON-OFF operation of some systems.

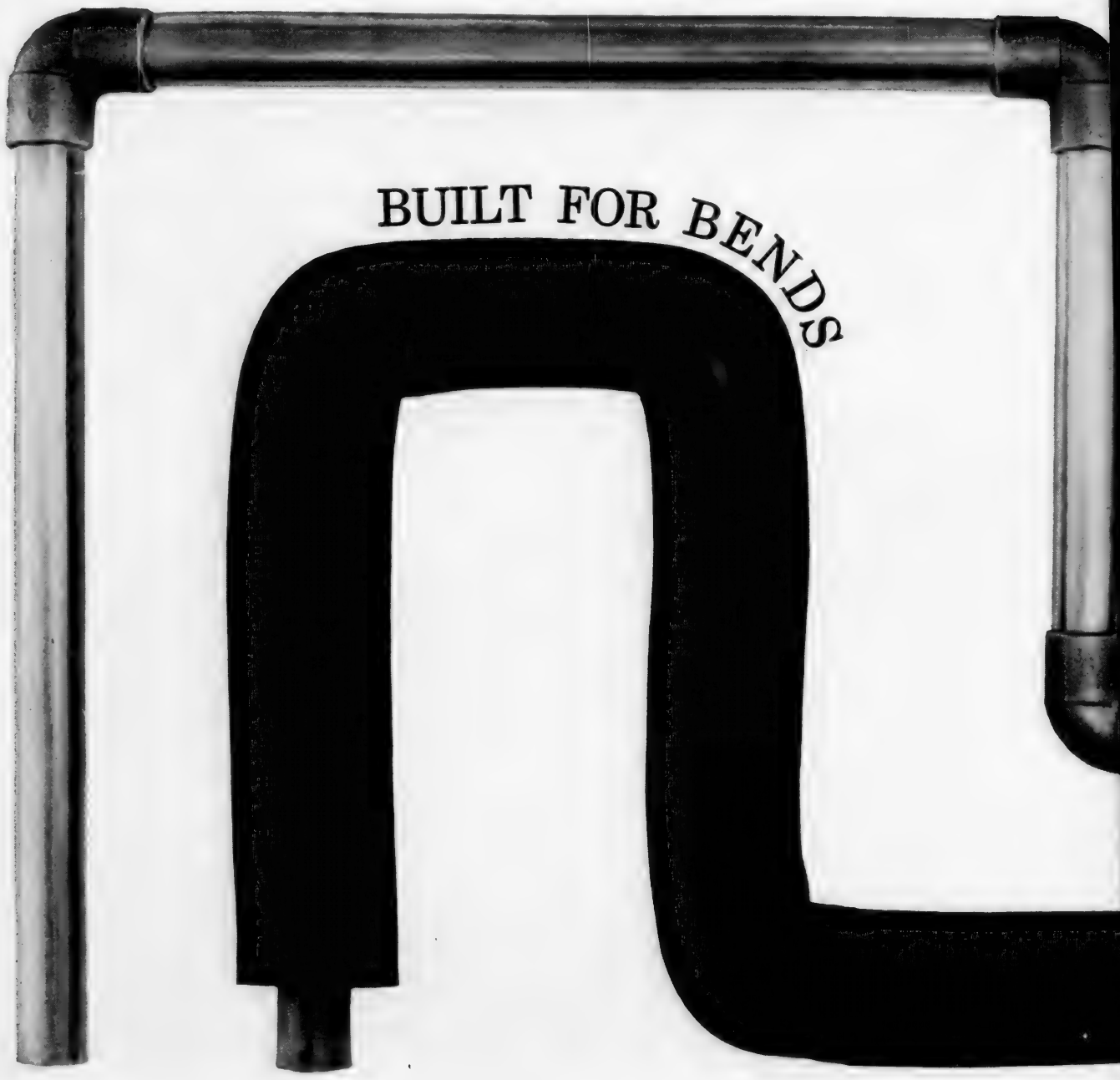
Get all the facts on the outstanding economy, dependability, and efficiency of gas-operated Ready-Power Air Conditioning. Call your local Gas Company, or write to The Ready-Power Company, Detroit 14, Michigan.



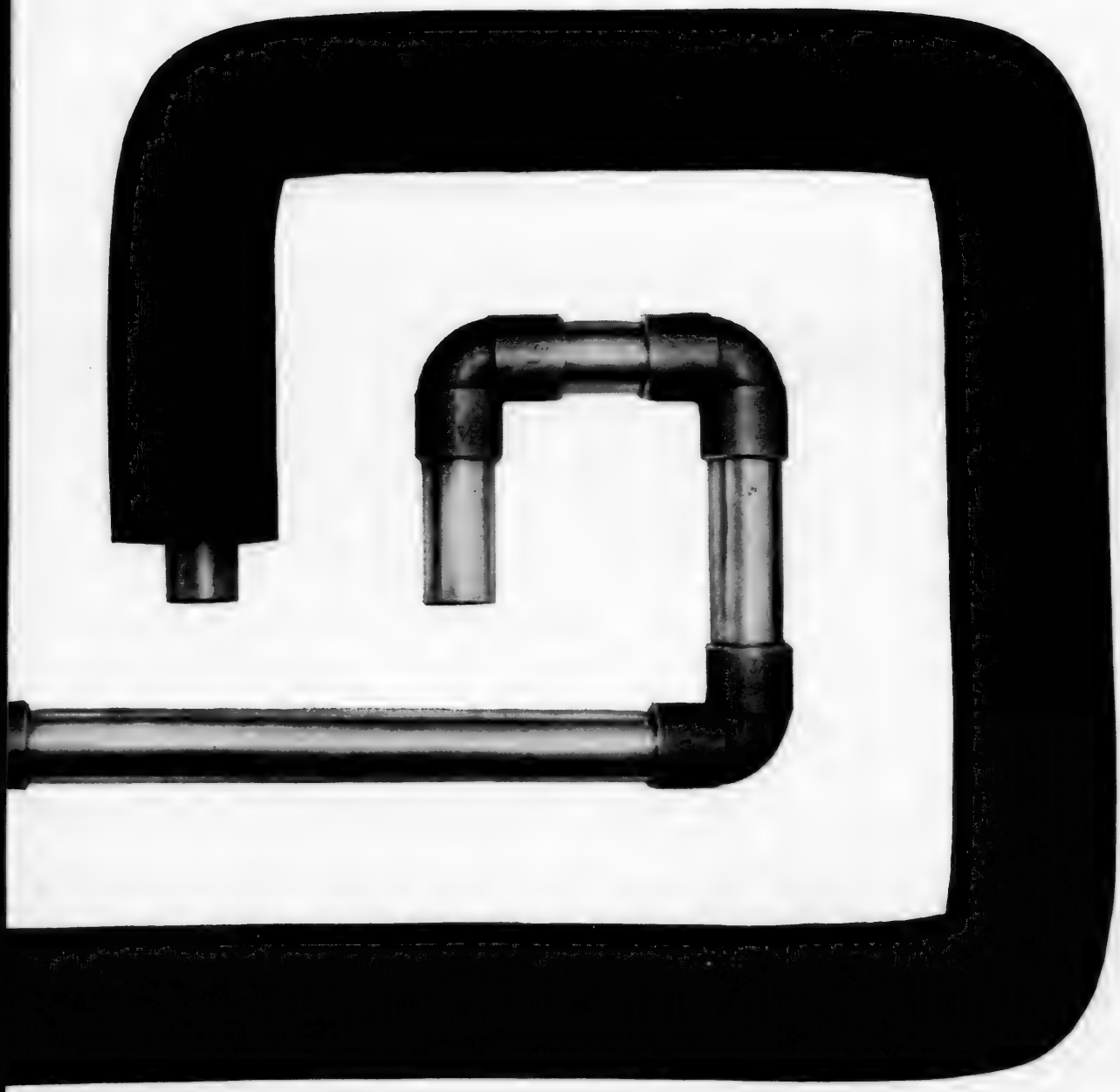
American Gas Association

FOR AIR CONDITIONING GAS IS GOOD BUSINESS!

Gas-operated Ready-Power Air Conditioning uses natural gas engine-driven compressor units, condensing units or matched chiller-condenser units. Ready-Power offers packaged systems with capacities from 20 to 375 tons.



J-M Aerotube...a flexible, anti-sweat insulation designed for quick installation on bent tubing!

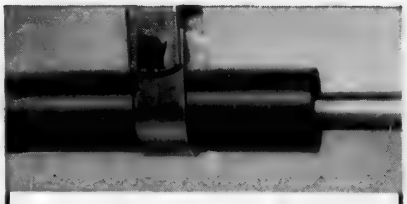


Now you can end the problem of pipe condensation on any indoor line quickly, easily and economically. With Johns-Manville Aerotube® even the most complex bend is a snap to insulate.

Aerotube is a flexible, foamed-plastic pipe insulation for use at temperatures from 32F to 220F. Its closed-cell structure prevents the passage of moisture under normal design conditions on indoor lines.

Because Aerotube is a flexible product (you can actually tie it in knots), it permits unique installation economies. The six-foot lengths go on quickly and easily. On new installations, simply slide Aerotube over tubing or pipes. For existing installations just slit Aerotube, snap it on and cement joints. That's all. Field reports show that installation costs can actually be cut in half.

If you have a condensation problem on heating, plumbing or air conditioning service lines, Aerotube can solve it. For full details, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.



ALSO AVAILABLE...
A RIGID AEROTUBE

For compression-free insulation at pipe supports or for underground use, J-M's rigid Aerotube is recommended.

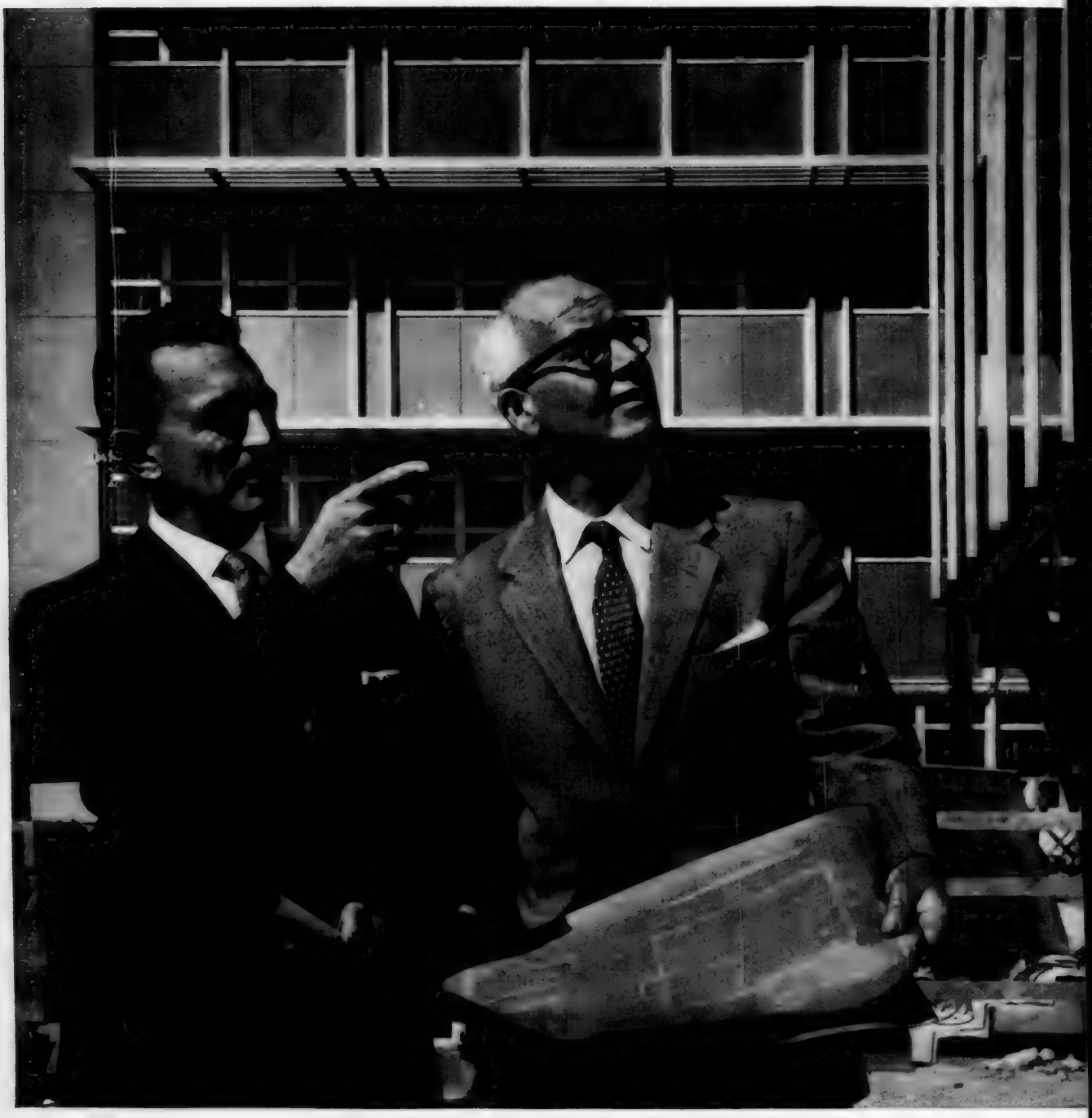
JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

JOHNS MANVILLE JM PRODUCTS

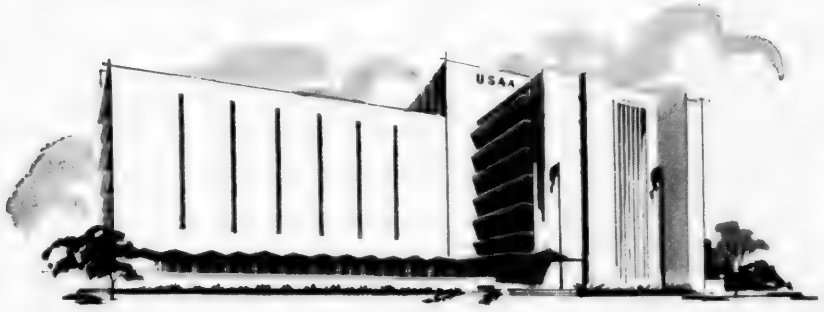
Mr. Kurt C. J. Monier, President, A. J. Monier and Company, Inc., mechanical contractor for the United Services Automobile Association building, San Antonio, says:

"We found just the in the Honeywell



Mr. Monier and Col. R. C. Singer, U. S. Army, Ret., USAA Building Superintendent, observe work on the new wing. The Honeywell Selectographic installation will help tie the air conditioning systems of the two buildings together.

flexibility we needed Selectographic"



UNITED SERVICES AUTOMOBILE ASSOCIATION
ARCHITECTS: Aulee B. & Robt. M. Ayres
ASSOCIATED ARCHITECTS: Phelps & Dewees & Simmons
MECHANICAL ENGINEER: G. M. Baker
MECHANICAL CONTRACTOR: A. J. Monier and Company, Inc.

The Selectographic DataCenter* at USAA will centralize air conditioning control in the present building and new wing, and can easily be expanded to handle future additions as well.

"Selectographic's built-in flexibility made it a natural for the USAA job," says Mr. Monier. "When the company planned their new wing, they decided to centralize control of the air conditioning system to cut operating costs and assure maximum comfort. Ultimately, they want to supervise air conditioning in the present building from the same control center. They also want the panel to assimilate controls for all future additions. Selectographic, with its modular construction and system-by-system supervision, will handle the job perfectly."

The Honeywell Selectographic DataCenter at USAA enables one man to supervise the entire air conditioning system from the engineer's office. He can read and adjust temperatures, start and stop equipment, and perform other necessary functions merely by pressing buttons on the electronic console. Air conditioning in the present building will be supervised from this same set of controls.

Whatever your temperature control needs, Honeywell can satisfy them best. Honeywell is the *only* company that designs and manufactures all three types of control systems —pneumatic, electric and electronic. And Honeywell backs up every system with accurate specifications, prompt delivery and supervised installations. For details, call your nearby Honeywell office. Or write Honeywell, Dept. HV-6-141, Minneapolis 8, Minn. In Canada, write Honeywell Controls, Limited, Toronto 17, Ont.

**Trademark*

This is the type of Selectographic DataCenter that is being installed in the USAA building. The permanent graphic diagrams, pilot and alarm lights, instruments and switches around the console are all enclosed in standardized modules. Additional controls can easily be added in units that match the original panel perfectly.

Honeywell

HONEYWELL INTERNATIONAL Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

H HONEYWELL First in Control

GENERAL OFFICES BUILDING
ATLANTIC COAST LINE RAILROAD
Overlooking the scenic St. Johns River,
Jacksonville, Florida

KEMP, BUNCH & JACKSON
architects

VAN WAGENEN & VAN WAGENEN
mechanical engineers

DANIEL CONSTRUCTION COMPANY
general contractor

HENLEY & BECKWITH, INC.
plumbing contractor

ALL STATE PIPE SUPPLY COMPANY, INC.
plumbing wholesaler

Performance records of millions of Sloan Flush Valves indicate that when COAST LINE's building is 50 years old its Sloan Flush Valves will still provide dependable service.

Moreover, Sloan Flush Valve maintenance costs are likely to be among the lowest in the building maintenance budget...(as little as 1½¢ per valve per year!)

• • •

Because the Sloan ROYAL is acknowledged as the world's most successful flush valve, attempts have been made to imitate some of its most important features. But why gamble with substitutes when you can plan for the life of the building confidently with Sloan? Specify and insist upon performance-proven, time-tested Sloan Flush Valves.

SLOAN VALVE COMPANY • 4300 WEST LAKE STREET • CHICAGO 24, ILLINOIS

SLOAN
FLUSH VALVES

Ray Edwards Answers Some Questions On:

WHY IT WILL PAY YOU TO SPECIFY EDWARDS HEATING EQUIPMENT

Q. All right, Ray, answer that question: "why will it pay me to specify Edwards hydronic equipment?"

A. Edwards makes your job easier and saves you valuable time.

Q. How?

A. Edwards offers a true package. Everything having to do with the hydronic heating system can be specified from one source — that means: boiler, motorized valves, circulator, baseboard radiation. Why spend your time searching and figuring when you can get everything from one manufacturer? All Edwards heating units come completely wired so that no further on-the-job wiring is required.

Q. That's all very well, but the most important factor to me is the company behind the product—

A. Good, Edwards has been for many years a basic manufacturer of heat transfer components and equipment for residential, commercial and industrial use. We have gained a reputation for leadership in developing new systems and equipment —

Q. For instance?

A. Let's take Zone Control which Edwards pioneered. Zone heating, properly engineered, will save the end — user up to 30% in fuel costs.

Q. Just what is Zone Control?

A. In an apartment or other commercial building job, for instance, each tenant selects his own heat. To the building owner, this means very economical fuel consumption. Fuel savings of 25% to 30% are possible.

Q. Why does Edwards Zone heating cut fuel costs for the apartment owner?

A. The occupants on the upper floors do not get so hot that they have to open windows. A multistory apartment house is like a giant chimney—the upper floors receive most of the heat *unless the apartments are individually controlled.*

Q. Any other reasons why it pays to specify Edwards equipment?

A. Labor-saving installation. The Edwards heating unit comes complete with plug-in electrical connector, built-in automatic air elimination devices and correctly sized expansion tank. The plug-in connector permits the installing contractor to test the system before the building is completed and to start heat within the building.

Q. How long does it take to install your system?

A. Even the largest boilers can be set up and in operation in less than a day. Long-length baseboard radiation covers go in *fast* without fussing with splice pieces and extensions. Length of covers is up to 20 feet.

Q. How much room does the heating unit take?

A. Not very much. A 10′ x 15′ equipment room is all you need for a 100 unit apartment. This gives the owner more room for more apartments.

Q. How about price?

A. The Edwards system has the lowest installed price of any system being marketed.

Q. I understand we can use your system for heating swimming pools and snow melting.

A. True. For heating a swimming pool, just ask us to add a low-cost inter-changer and Zone Control valve. The same applies for snow-melting.

Q. What about cooling?

A. Edwards Airvec is the answer. This is another example of Edwards pioneering. It consists of a noiseless gravity operated air-cooled condenser connected to noiseless gravity air cooling units inconspicuously installed in the apartment rooms near the ceiling. A packaged zoned water chiller supplies the individual cooling units. Airvec is completely packaged in a manner never before offered to this industry.

Q. I understand that Edwards has detailed help available to engineers. Please explain.

A. Probably most important, for all types of jobs, large or small, new or remodeled, we offer you our complete handbook of Zone heating and cooling plus a *brand new* "Engineers Portfolio". The latter has complete details (on 17″ x 22″ broadsides) on heating and cooling for homes, apartments, motels and churches. Check the coupon below and send it to me.

EDWARDS ENGINEERING CORP.

Pompton Plains, N. J.
TEmple 5-2808

PACKAGED HYDRONICS THROUGH YOUR CONTRACTOR

We are interested in:

- ☐ Edwards complete handbook — catalog
- ☐ Edwards Engineers Portfolio

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

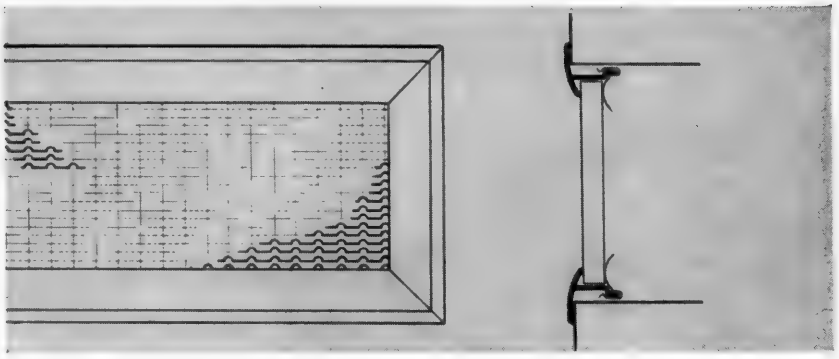
ACHV-12

Making air behave . .

Distinctive styling to suit the room

. beautifully!

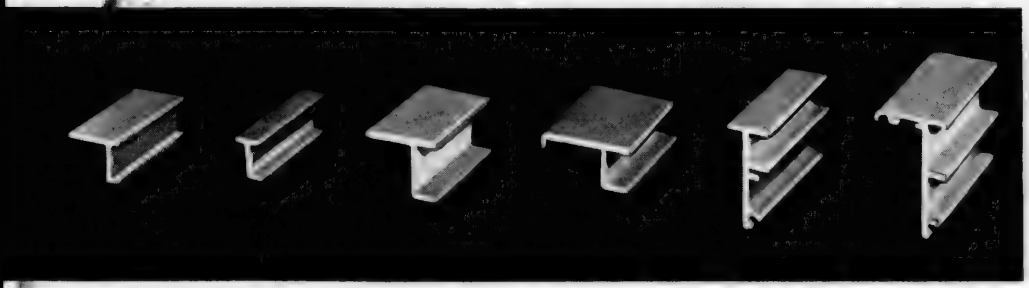
Comfort-proven Uni-Flo sidewall diffusers available in a wide variety of extruded aluminum frames



Now you can combine the air distribution superiority of the Uni-Flo sidewall diffuser with any one of a wide variety of attractive aluminum frame styles—to make air behave *beautifully* in more ways than one. Each extrusion opens a new realm of design opportunities to the architect—yet each possesses the architectural grace to blend inconspicuously into the room decor.

The adjustable Uni-Flo core available with *exclusive* extruded aluminum frame diffusers creates a controlled turbulence that thoroughly diffuses the conditioned air *before* it reaches the occupancy zone. This principle of air diffusion, long proven in the field and in the laboratory, creates Comfort-Chart conditions—completely eliminates drafts commonly associated with "streamlined" diffusers which can drop masses of cold air onto the people in a room.

Uni-Flo diffuser performance is guaranteed. Quiet, unobtrusive sound levels are assured in advance of installation because Barber-Colman provides comprehensive noise level data for every diffuser size and operating condition. For detailed information, call your local Barber-Colman office.



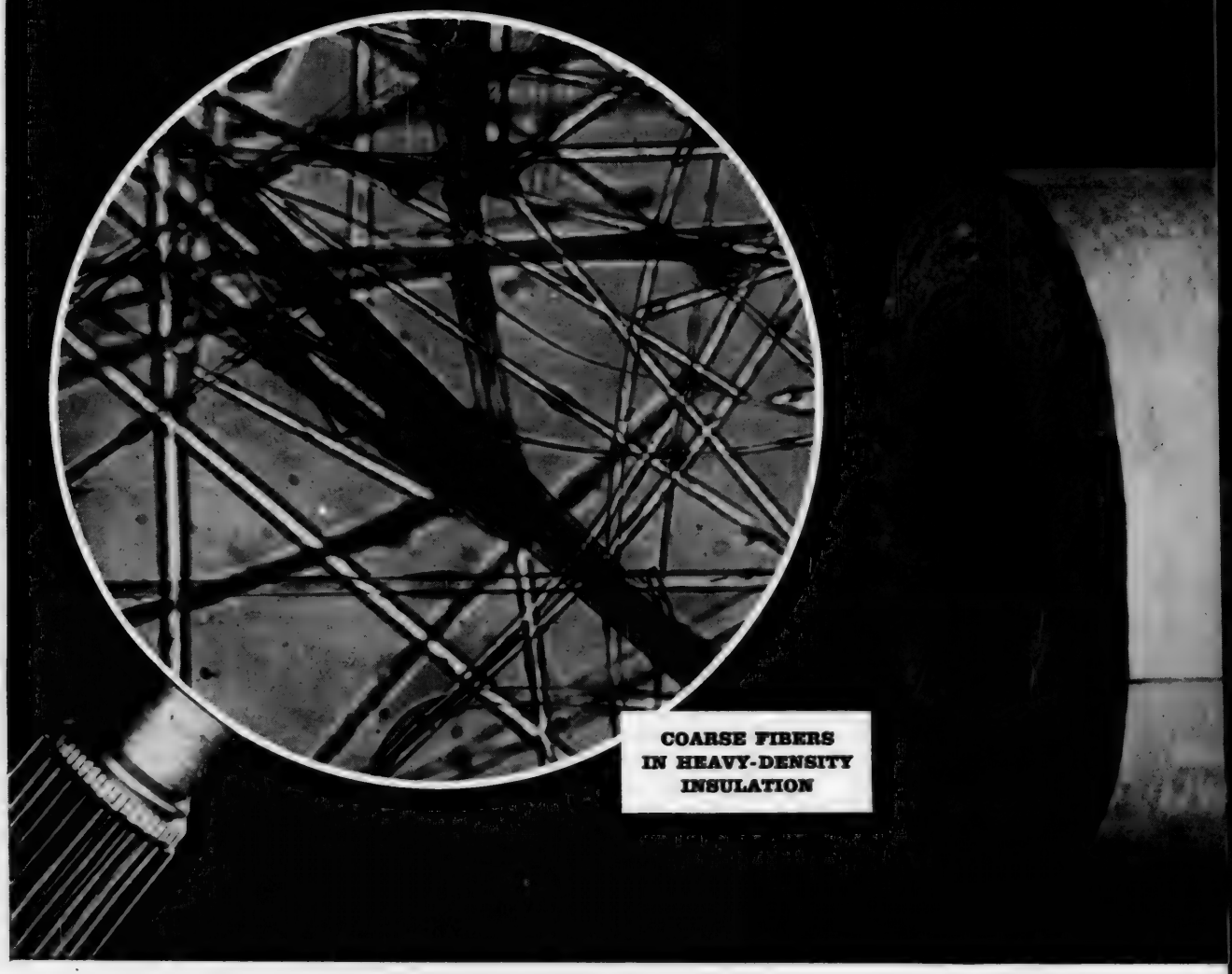
BARBER COLMAN

BARBER-COLMAN COMPANY

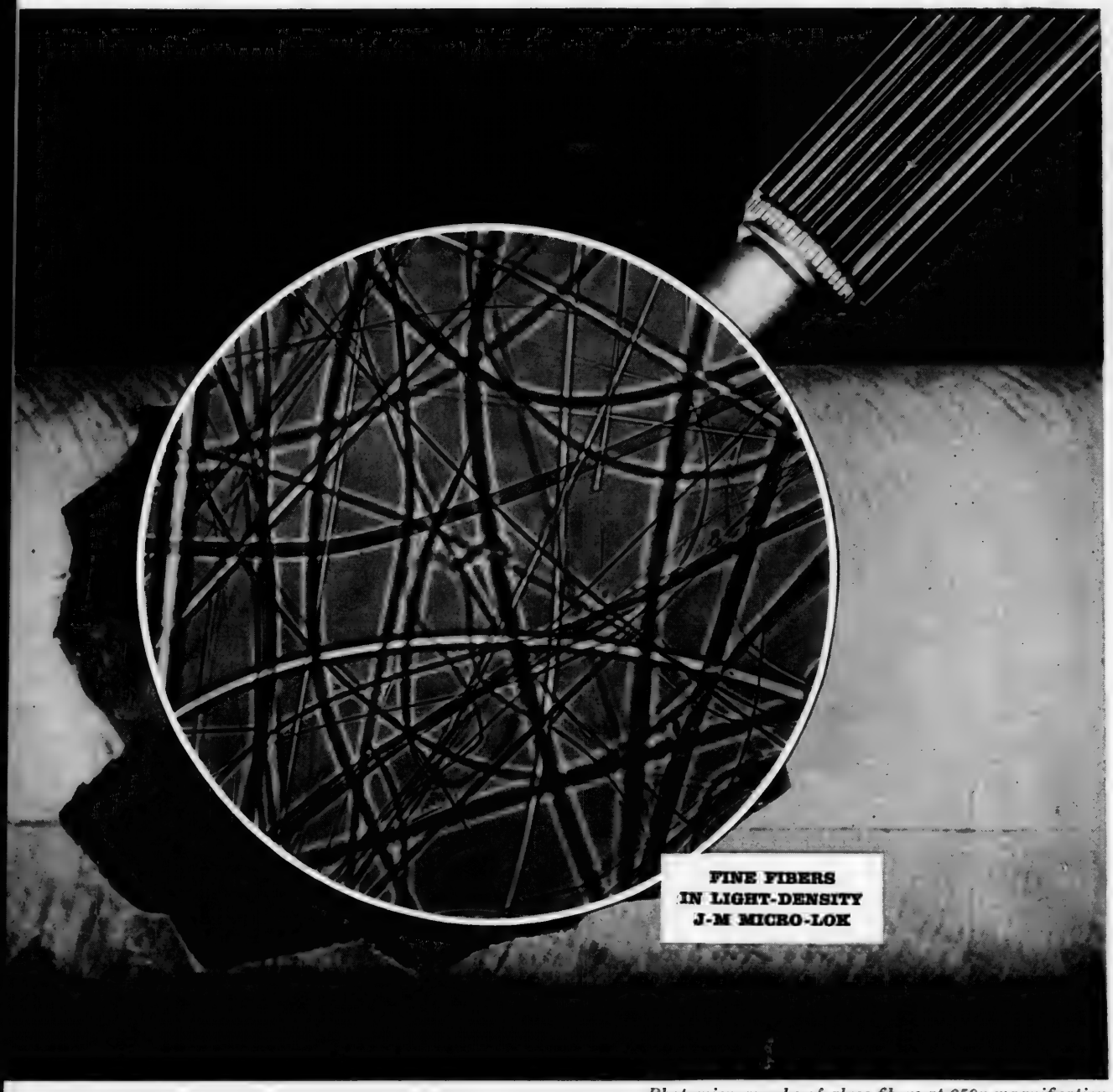
Dept. X, 1102 Rock Street, Rockford, Illinois

. . . where originality works for you

THE BIG DIFFERENCE IN PIPE INSULATIONS:



See why lighter density makes **J-M MICRO-LOK** most effective... most economical



Photomicrographs of glass fibers at 250x magnification

Micro-Lok pipe insulation is made of long, resilient, extremely fine glass fibers. This means that infinitely more and smaller air pockets are created than would be formed by coarse, more rigid fibers made by an old-fashioned process.

Thus, Johns-Manville Micro-Lok provides considerably more resistance to the passage of heat, yet its density is only about half that of pipe insulations made of coarse fibers.

Specifically, fine-fibered, light-density Micro-Lok has a k factor of .245 at 100F mean temperature — about 10% *lower* than coarse-fibered, heavy-density products.

Micro-Lok's superior resiliency also means that its surface can more readily absorb accidental blows without puncturing or ripping the vapor barrier jacket.

Micro-Lok is highly effective for temperatures from minus 120F to 370F. Made in all standard IP and CT sizes and wall thicknesses, Micro-Lok is available with a wide range of factory-applied jackets including canvas, general purpose and flame-resistant vapor barriers such as the new Flame-Bar. For details, write to J. B. Jobe, Vice-President, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.

JOHNS-MANVILLE
FIBER GLASS

JOHNS-MANVILLE JM PRODUCTS

Milady's Fan is just about the *only* fan you won't find in the complete Ilg line. So why go to the expense and bother of getting a propeller fan from one source . . . roof fans from another . . . centrifugals from a third? Ilg has them all . . . complete selection *within* each category, too.

And regardless of the Ilg fan you pick, you can be sure of performance as maintenance-free as a fan can be. Careful dynamic balancing of all component parts . . . plus electronic checks of Ilg-built motors and Ilg-patented Type "Q" propeller fan and centrifugal fan wheels . . . makes certain that smooth, vibration-free operation is as much a part of the product as the Ilg "One-Name-Plate" pledge of performance.

HERE'S ONE OF THE FEW FANS YOU CAN'T GET FROM

BE RIGHT . . . WRITE IN

ILG®

YOUR CHOICE OF CENTRIFUGAL FANS...

Ilg BC Airfoil Centrifugals. Direct-connected and belted types. Aluminum wheel and housing. Single and double width. WRITE FOR BULLETIN DB2-100.

Ilg BBS Belted Centrifugal Fan. Backward blade. Steel housing. Single and double width. WRITE FOR BULLETIN BB-105.

Ilg BU and FU Util-A-Sets. Belt drive. Forward curved wheel and backward blade types. Capacities up to 23,000 CFM. WRITE FOR BULLETIN DB2-200.

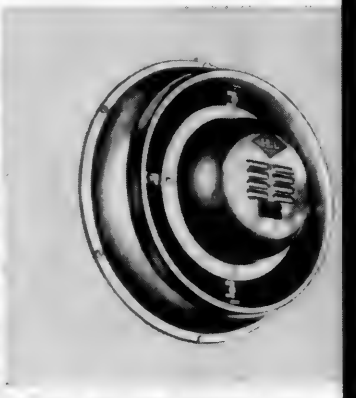
Ilg Type B Direct-Connected and Type FU Belted Util-A-Sets. Forward curved wheels. Capacities up to 2400 CFM. WRITE FOR CATALOG DB2-306.

PROPELLER AND CENTRIFUGAL ROOF FANS...

Ilg UB Upblast Roof Ventilators with butterfly dampers. Direct-connected. Airfoil blades. 5 sizes. WRITE FOR BULLETIN DB3-300.

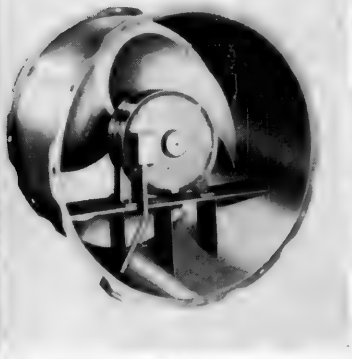
Ilg L-CRF Airfoil Centrifugal Fan Roof Ventilators with patented pressure-cooled direct-connected motor. 15 sizes. WRITE FOR BULLETIN DB3-200.

Ilg L-LSQ Propeller Fan Roof Ventilators. Direct-connected. Type "Q" wheel. 11 sizes. WRITE FOR BULLETIN DB3-100.

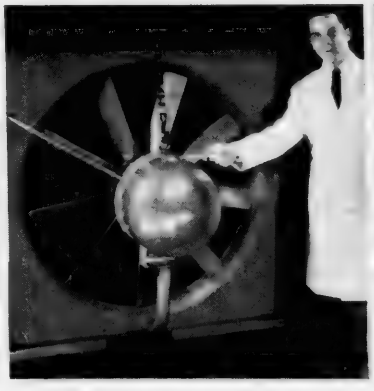


Ilg Type CWF Airfoil Centrifugal Wall Exhausters. Direct-connected, pressure-cooled motor. 5 sizes. WRITE FOR BULLETIN DB3-200.

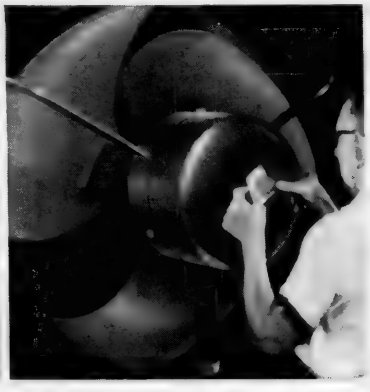
DIRECT-CONNECTED AND BELTED PROPELLER FANS



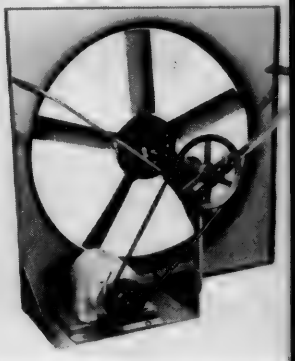
Ilg TA Tubeaxial Propeller Fans. Direct-drive. 3-blade and 5-blade design. Totally enclosed motors. 8 sizes. WRITE FOR BULLETIN DB1-100.



Ilg PF Square Panel Propeller Fans. Direct-connected, self-cooled motors. Airfoil design and Type "Q" blades. WRITE FOR BULLETIN DB1-106.



Ilg LQ Propeller Fans. Direct-connected. Self-cooled motor. Patented Type "Q" wheel. WRITE FOR BULLETIN DB1-100.



Ilg Type PFB Belted Propeller Fans. 5-blade airfoil design. Totally enclosed motors. 3 sizes. WRITE FOR BULLLETIN.

ILG ELECTRIC VENTILATING CO.

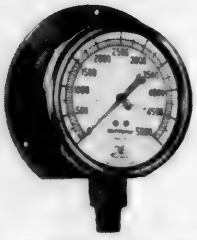
2851 No. Pulaski Road, Chicago 41, Ill.
Offices in 60 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association, Inc.

Marsh Makes It!

If it's a pressure gauge, dial thermometer, or needle valve, Marsh makes it...makes it in every form to suit every need...makes it better in the opinion of thousands of discriminating users. Only a few key products are illustrated here, but hundreds are described in Marsh Catalogs. Ask for information covering the product or products in which you are interested.

PRESSURE GAUGES



"Mastergauge"—the world's most effective pressure gauge for extreme service.

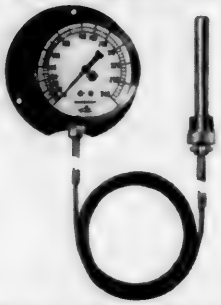
"Master-test"—"Mastergauge" quality in a gauge for services requiring high accuracy.

Quality series—second only to "Mastergauge" and "Master-test" for tough conditions.

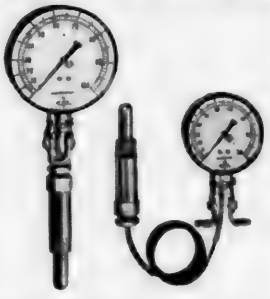
Standard series—best moderate-priced gauge for run-of-plant conditions.

DIAL THERMOMETERS

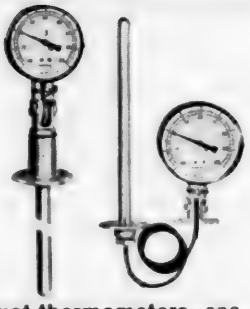
Vapor tension thermometers—direct mounted type. Many sizes; ranges.



Distant reading thermometers—vapor-tension and gas filled types in many sizes; ranges.



Piping thermometers—specially designed for piping. Types for all purposes, including distant reading.



Duct thermometers—specially designed for all conditions including distant reading.

NEEDLE THROTTLING VALVES

Alloy steel—complete series of sizes and patterns. Pressures up to 10,000 psi.

416 Stainless steel—complete series of sizes and patterns in 416 stainless. Pressures up to 10,000 psi.

316 Stainless steel—complete series of sizes and patterns in 316 stainless. Pressures up to 6,000 psi.

Panel mounted—all valves—alloy steel, 416 stainless, and 316 stainless—available in panel mounted types.

MARSH

MARSH INSTRUMENT COMPANY, Dept. U, Skokie, Ill.
Division of Colorado Oil and Gas Corporation
Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada.
Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.
Eastern Seaboard Warehouse: Marsh Instrument Company, 1209 Anderson Ave., Fort Lee, N.J.

. . . I can get just the fin spacing, tonnage and CFM I want."

Now, Halstead & Mitchell gives you a choice of 6, 7, 8 or 10 fins per inch . . . makes it much easier to match a central fan-coil unit to a particular job or to meet specifications.

And look what else H&M offers: a selection of three coil face areas for each model; direct expansion or chilled water cooling coils (1 to 8 rows); hot water, standard steam or non-freeze steam heating coils (1 or 2 rows); cooling capacities of 3 to 92 nominal tons with 880 to 47,750 CFM; Turbu-Flo coils arranged for right or left-hand connections; horizontal or vertical mounting for discharge in any direction . . . and every accessory item you need to simplify your installation.

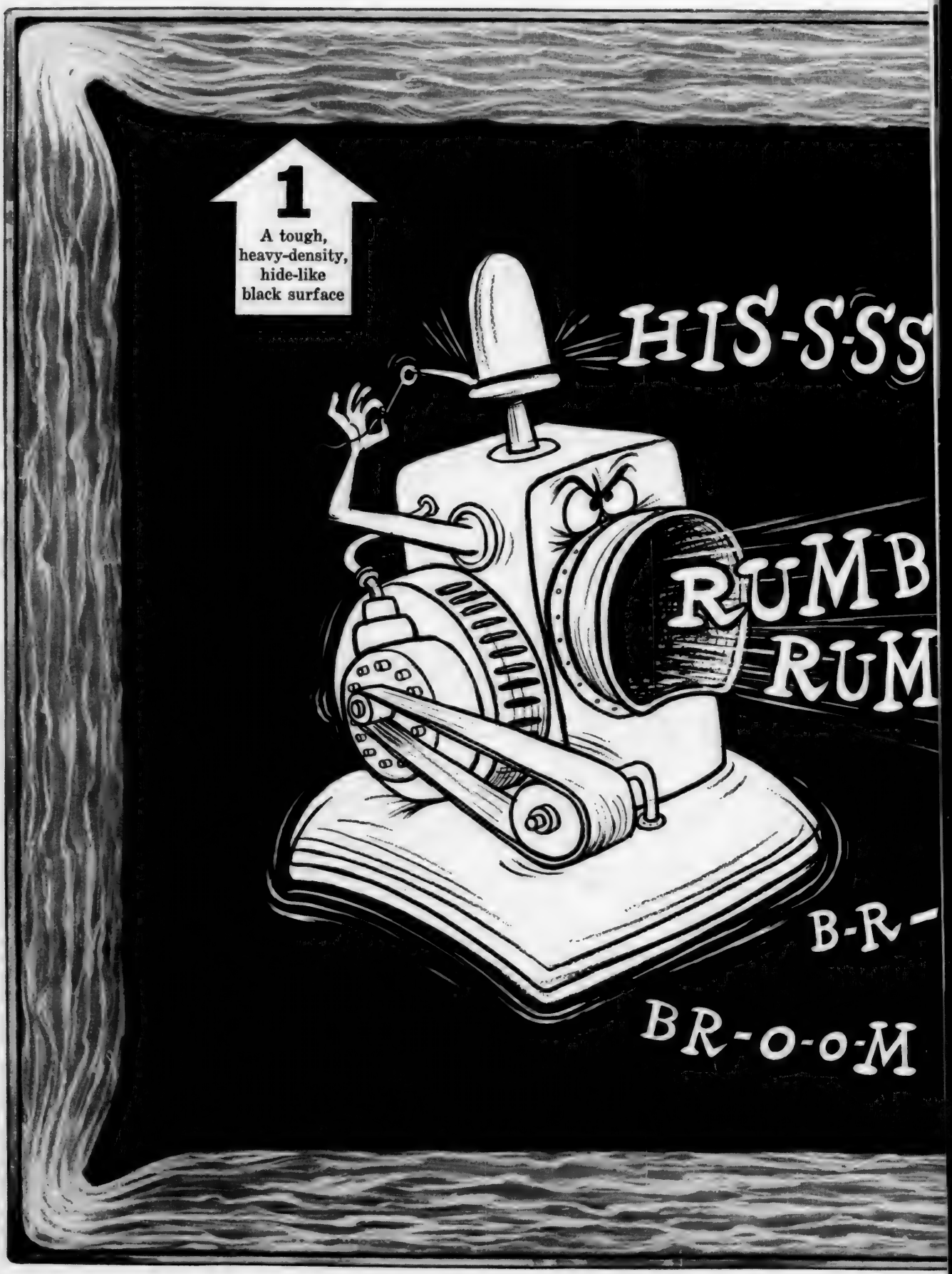
Why don't you check H&M Central System Air Conditioners? Call your wholesaler or write for Bulletin AHU-100. Halstead & Mitchell Co., Dept B12, Bessemer Bldg., Pittsburgh 22, Pa.

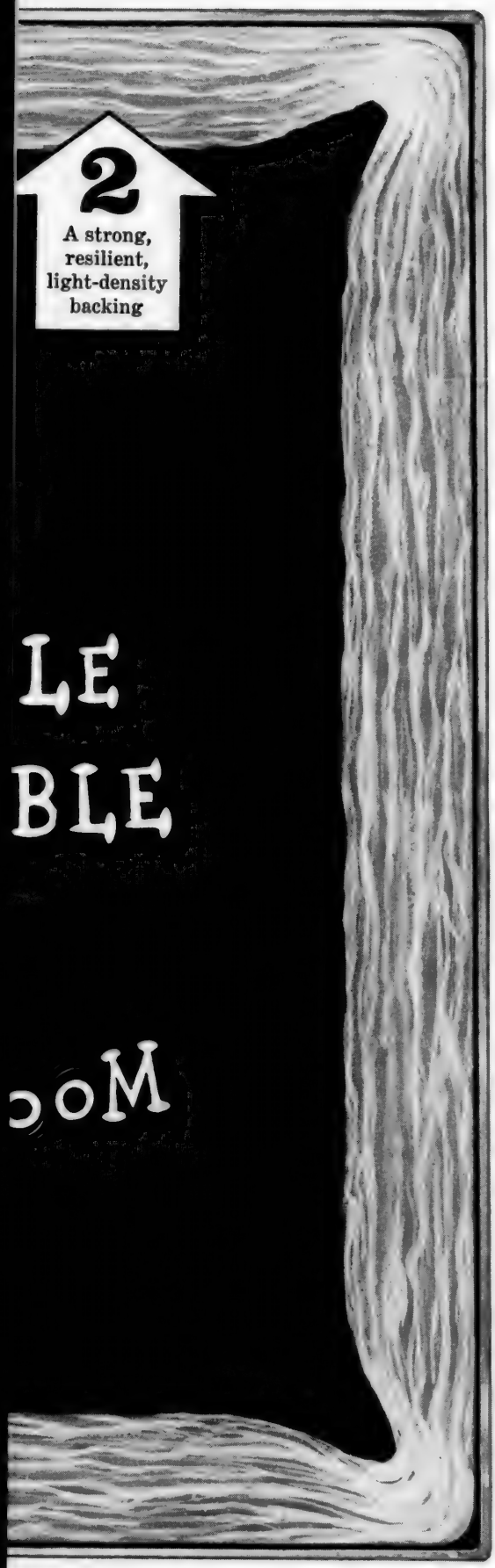
Export Representatives: Sabal-Kielman, Inc., 15 William St., New York 5, N. Y.

Central System Air Conditioners • Air-Cooled Condensers • Cooling Towers
Water-Cooled Condensers

AH SERIES
AIR HANDLER

HM
Halstead & Mitchell


1
A tough, heavy-density, hide-like black surface
HIS-S-SS
RUMB
RUM
B-R-
BR-O-O-M



UNIQUE CONSTRUCTION MEANS THAT

"Dual-Density" J-M Micro-Bar Duct Liner absorbs a wider range of disturbing noise!

J-M Micro-Bar is an entirely new concept in sound-absorbent and fire-resistant fiber glass duct liner. Micro-Bar is a combination of *two densities* of insulation, making it highly effective in absorbing duct noises at high frequencies, low frequencies and the range in between.

Johns-Manville Micro-Bar consists of a resilient, light-density backing and a tough, heavy-density surface. This combination of densities effectively soaks up fan noise . . . whistling due to high-velocity air . . . noise carried from room to room through the duct.

Micro-Bar has an extremely low fire hazard rating . . . a low surface coefficient of friction. Thermal performance is excellent. And easy application techniques permit forming of integral, non-metallic nosings. In fact, you just can't find another duct liner where *all* properties and characteristics work together so well to help assure proper installation.

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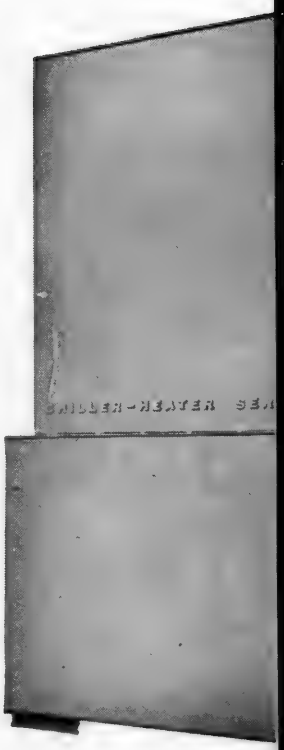

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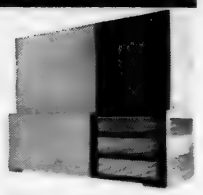

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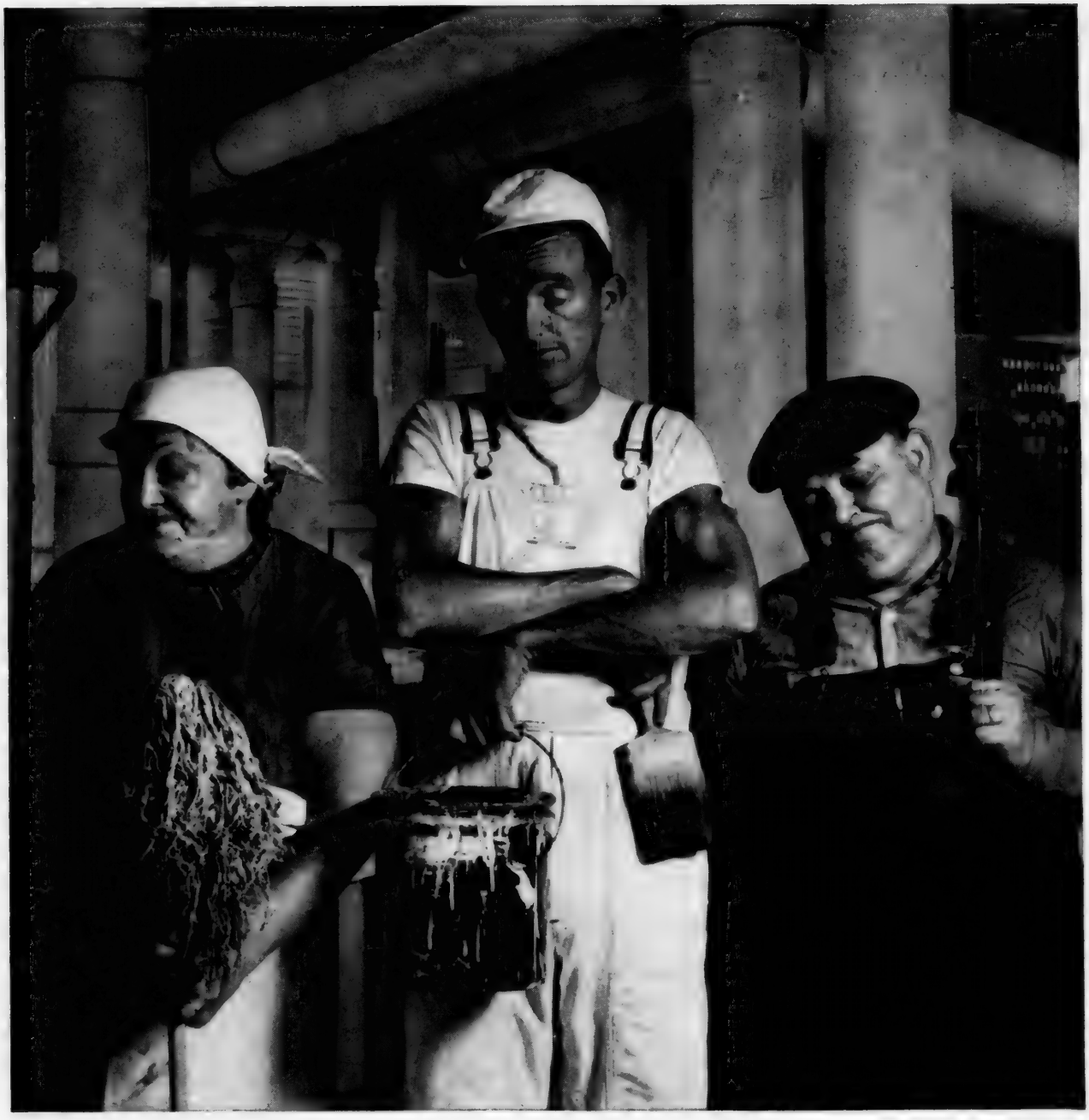

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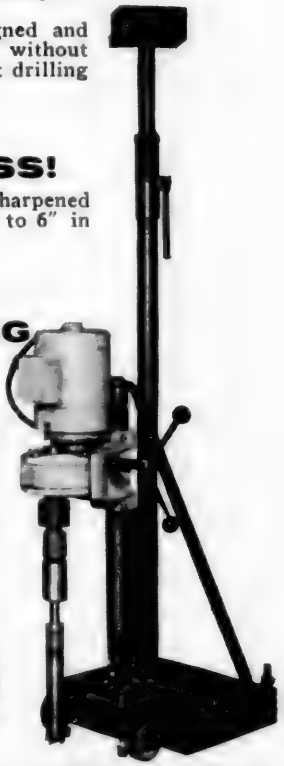

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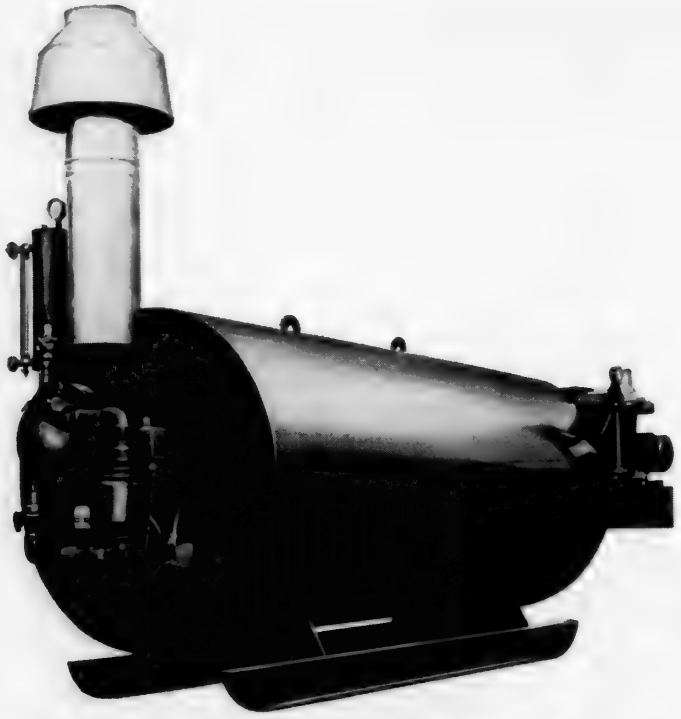

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for Hitchins, Ky., General Refractories Co. Plant

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easily installed A complete and automatic package, the SCALEFREE 230 was installed by the maintenance crew at the plant in 16 manhours. Only inlet and outlet piping and simple electrical connections were required for the installation. The heater can be operated with any type of industrial gas – manufactured or natural.

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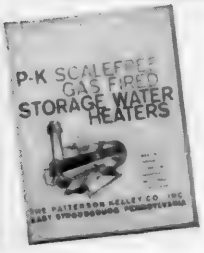
*Patent pending

Patterson Kelley

Water Heater Division, East Stroudsburg, Penna.

Installation of the SCALEFREE 230 took maintenance crew at General Refractories only 16 manhours.



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It's the Nash CSM

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
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- Flexibility permitting addition of radiation without changing basic pump installation.
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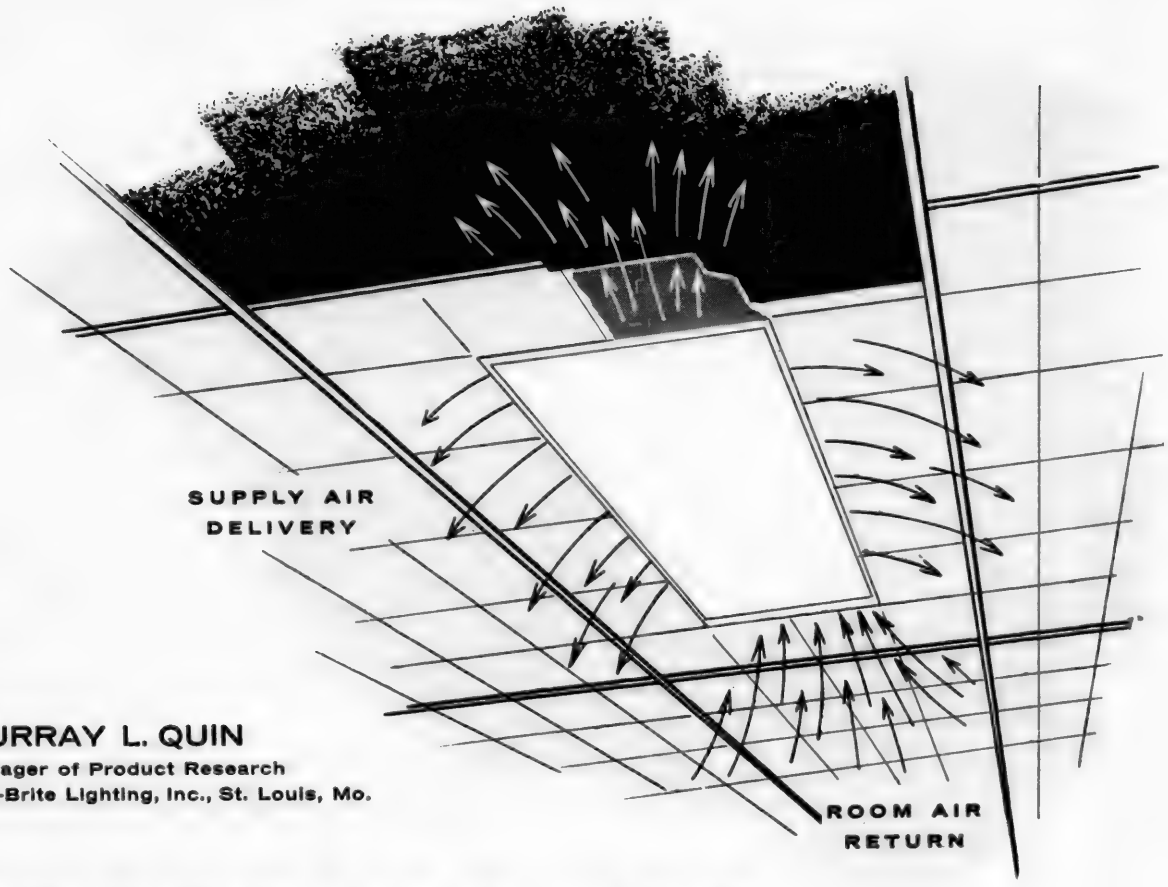


MURRAY L. QUIN
Manager of Product Research
Day-Brite Lighting, Inc., St. Louis, Mo.

UNSCRAMBLING HEAT and LIGHT

THE combination light and air-diffusing troffer system has been enjoying an increasing amount of success. These troffers can handle supply or return air interchangeably. As a result, any combination of two or more interior-zone modules can become a self-sufficient air-conditioned and illuminated space.

While the system overcomes such problems as the ceiling clutter of both lighting equipment and air diffusers, and the need for flexibility in buildings requiring movable partitions, it does not touch upon the more serious problems currently being faced by both the lighting and air-conditioning industries, the most basic of which is the heat load created by currently accepted lighting levels for office buildings. Increased heat loads which will result from even higher lighting levels anticipated in the future.

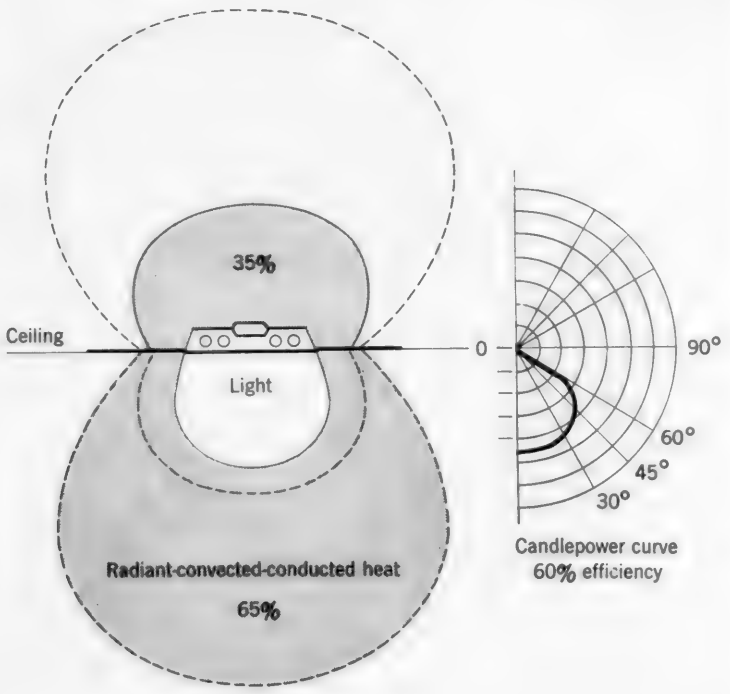
More Lighting Would Double Cooling Load

Since 1917, recommended light levels for the average office building have increased some 2,000%. The average in use today is about 50 footcandles, a level of illumination which accounts for 25-30% of the total air conditioning load.

Since 1958, the Illuminating Engineering Society has recommended an average 100 footcandles of illumination. This can require a 30% increase in refrigeration plant tonnage. And, to provide the air-handling capacity necessary to offset the added heat load based upon a conventional 20-deg F temperature differential, the air distribution system within a building may have to be increased 50%. Should the recommended lighting level be doubled again to 200 footcandles, and this is not inconceivable when measured against past growth, the initial refrigeration plant must be doubled in size, and the air distribution system must handle two and a half times the original capacity.

Theoretically, the higher heat load could be countered by raising the temperature differential of supply air up to 30 deg, and increasing the number of air changes beyond the current maximum of 20 per hour. However, established comfort standards would be difficult to maintain. And further, the added cost of installing and operating such systems appears to nullify most of the calculable benefits from the increased illumination in the average building.

Fig. 1. Energy distribution and relative lighting efficiency of 2 x 4 enclosed troffer with four 40-watt fluorescent lamps. Reversal of upward and downward energy components, as shown by dotted lines, would effectively reduce heat load in conditioned space.



Breaking the Thermal Barrier

In addition to the air conditioning problem, another basic problem also appears. Fluorescent lamps are extremely sensitive to temperature. A distinct relationship exists between the amount of light generated and the ambient temperature of their immediate surroundings.

Lumen values for lamps are rated for operation in a still air of 77-deg ambient. Lamps rarely enjoy this optimum condition within recessed troffers because of restricted convection currents for cooling, heat gain from ballasts and from adjacent lamps, and often from the heat build-up in unvented ceiling cavities. It is not uncommon for bulb-wall temperatures to reach 120 or 130 deg when a combination of these adverse influences are present.

Losses in potential light output can run as high as 15 to 20%. Further, additional uncontrolled heat build-up within the troffer from higher light levels can result only in a greater proportion of the power consumed being converted into heat, rather than light, energy. Today, of the total heat gain from a 2 × 4 ft enclosed troffer with four 40-watt lamps, *as much as 65% will enter the room* with the balance distributed upwardly into the ceiling cavity. See Fig. 1.

Thus, the combination of increased air conditioning costs, and the efficiency loss in lighting output, can be a serious economic penalty. What this clearly means is that after some 80 years of effort to provide more light in our commercial buildings, we have reached a thermal barrier, similar to the thermal barrier of ultra-sonic flight.

A New Kind of Troffer

If this barrier is to be broken, a method is needed whereby we may:

1. Increase the amount of light energy and reduce the amount of heat energy transmitted into occupied space, and

2. Utilize the rejected heat energy more effectively where needed. A method to meet these two objectives has been found. Basically, the method goes just beyond troffers currently designed for selected supply or return, which are not very efficient for heat transfer and cannot be effective heat converters. It incorporates *an air exchanging troffer combining simultaneous air supply and return with increased light-producing characteristics.*

The exchanger delivers air in a manner similar to present air-diffusing troffers. However, room air is exchanged by inducing the return flow through the troffer housing from end-to-end. With respect to lamp orientation, supply air is delivered in a crosswise direction, and returned in a lengthwise direction. (See headpiece drawing.)

A maximum heat rise in the return-air stream is accomplished by convective transfer throughout the length of heated surfaces within the enclosed lamp compartment. Conditioned air is delivered through a bridge-like air panel straddling the mid-portion of the exchanger. A heat rise in this air is prevented by spacing walls of the air panel apart from the troffer. An insulating blanket may also be used.

The heat transfer characteristics of the air exchanger may be applied to both air-water and all-air

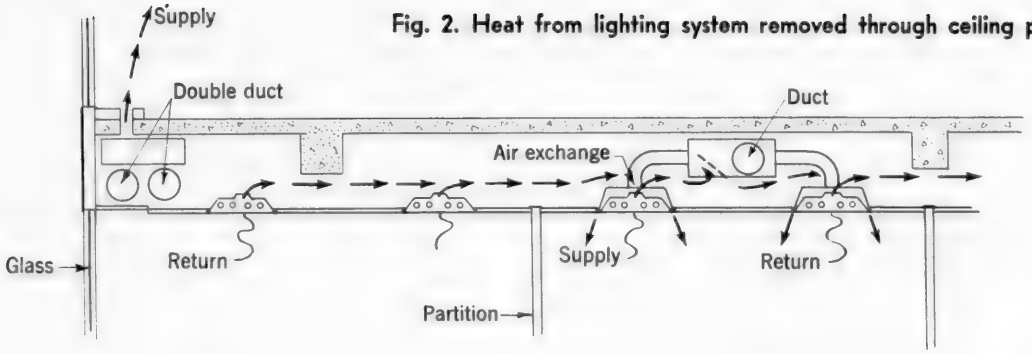


Fig. 2. Heat from lighting system removed through ceiling plenum.

cooling systems. Based upon office building modules averaging from 18 to 25 sq ft in area, and 9-ft ceiling, the volume of air available for return through the exchanger will range from approximately 10 to 30 cfm. With one exchanger per module, effective heat transfer can be achieved in this volume range. For example, a 2 × 4 ft exchanger can transfer the equivalent of 45% of the lamp wattage to a 20-cfm return-air stream.

Further, glass panels can be employed which separate light and heat. This will remove a heretofore untouched segment of the lighting heat load—invisible infrared radiation. By fusing an optical interference coating to the glass panel, almost all of the long-wave infrared energy will be reflected back into the exchanger where it will be absorbed and picked up by the return-air stream.

More Light, Less Tonnage

Therefore, through the combination of two heat transfer mechanisms, one for thermal convection, the other for thermal radiation, an exchanger can transfer as much as *60% of the total lamp wattage* into a 20-cfm return air stream. And, discounting the portion of consumed energy emitted as visible light, the total would be 70% of the total lamp wattage available in the form of generated heat.

In addition to this advantage, these units can produce at least 15% more light than conventional troffers having similar static photometric characteristics.

The final development of this exchanger means that a re-evaluation of electrical and mechanical systems will be needed. Required illumination levels can be provided with up to 15% less wattage than before. Conditioned space will receive only a third of the heat energy normally radiated into it, which will reduce cooling load requirements. The result will be lower air quantities or smaller temperature differentials.

Waste Heat Reclaimed for Heating

However, this is only one part of the total energy distribution diagram. Unless the heat energy which has been removed from the illuminated space can be utilized it will again become waste energy. By transferring it as needed, one of the paradoxes in building today will be overcome—use of energy in one part of a building to cool areas in which heat is being generated while additional energy is consumed to simultaneously heat another area.

For example, the availability of a constant source of heat energy, 90 deg, for instance, delivered from air exchangers to heat pumps would materially reduce installation and operating costs. Heat pumps in many areas of the country are laboring under extreme temperature gradients in summer and winter differentials. Sized for the summer cooling load, they need supplemental heat. Sized for the winter heating load, they have excess cooling capacity.

Further, with a constant heat source readily available from air exchangers, it is possible to achieve interior zone control without resorting to double-duct or terminal reheat systems. Induction boxes, which filter and mix the air returned to the ceiling plenum with primary air delivered in a single duct system, can easily provide the small temperature differences usually required to satisfy interior zone conditions.

Where installation of the air-exchangers exist, regularly scheduled in-service maintenance will have to be observed. Although relatively small quantities of return air are handled by each unit in what would be an average installation, depreciation due to dirt can be expected to be somewhat greater than that attributed to normal convective infiltration in recessed troffers. A sealed building environment, perhaps not too distant in the future, and further developments in the field of electronic air purification, will eventually obviate this problem.

Intra-Professional Cooperation Needed

While it is important for architects and consulting mechanical, electrical, and illuminating engineers as well as mechanical and electrical contractors to be aware of the development of the air-exchanger, it is even more important for them to realize that an increasing amount of co-ordination will be needed between the lighting and air conditioning industries.

A measure of co-ordination already exists because of the combination light and air-diffusing troffers. However, even more will be needed if we are to improve operations while at the same time effect economies. The air-exchanger and other developments make this a very real possibility.

CONTROL TIPS FOR RADIANT CEILING PANELS

JOHN WEAST
Application Engineer, Barber-Colman Co.
Rockford, Ill.

While the control of heating-only radiant ceiling panels is relatively uncomplicated, the control of cooling panels is more critical. While two types of control are applicable, the author disposes of one and tells how best to apply the other to two, three and four-pipe systems.

CEILING PANEL COILS FOR HEATING AND COOLING may be fabricated as grids, serpentine, or a combination grid-serpentine type. These coils may be in direct contact with and above the acoustical metal pans, or they may be suspended in the air space above the acoustical ceiling. The latter type is usually provided with fins for a better transfer of heat. Heating-only panels may be imbedded in the ceiling plaster.

The control of heating-only panels is relatively simple. Control of cooling panels, however, requires that design conditions be such that coil temperature does not fall below the space dew point and produce condensation on the coils or the ceiling. Since no moisture is removed from the air, ceiling panels can be used for sensible cooling loads only.

A central fan system is usually employed to take care of the latent load, providing dehumidification and also the ventilation requirement. In order to prevent condensation, it may be necessary to install a humidistat in the air space surrounding the cooling panel coils which will cut off the chilled water on a rise in humidity above the design dew point.

Two Types of Control

Basically, there are two types of control that are applicable to ceiling radiant panel heating: The two-position or on-off type, and the proportional type. Two-position control either fully opens or closes the valve, while proportional control positions the valve at some intermediate point to balance the load.

Throttling valves on hot water radiation often provide poor heat proportioning characteristics for two reasons: (1) the output of a hot water heat exchanger is not linearly related to flow; and (2) the flow through a proportioning valve is not usually linear with respect to valve position because of changes in system pressures.

With approximately 50% water flow through a proportional valve on the average installation, heat output is over 90%. The minimum controllable flow (approximately 5½%) through most proportional valves is large enough to provide approximately 30% of the heat output. Any reduction in flow simply results in a greater temperature drop, as the water

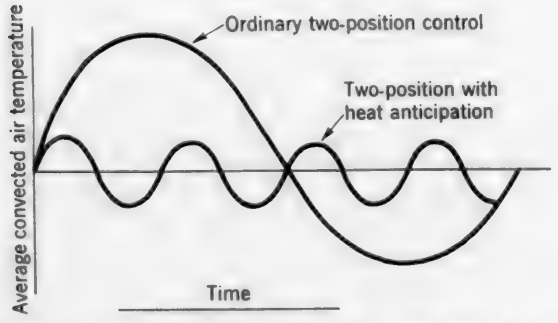


Fig. 1. Heat anticipation reduces the variations in convected air temperature by causing the valve to cycle more often.

remains in the panel a longer period of time. The increase in temperature drop substantially cancels the effect of reducing the flow. Because the minimum controlled heat source is approximately 30% of the total, the proportional valve will operate as two-position during the major portion of the season (whenever load is 30% or less of that at design conditions).

Another disadvantage of proportional control for a radiant ceiling is that as the valve reduces the flow, the gradient across the panel increases. This results in a panel that is warm at one end and cool at the other, which can conceivably cause varying comfort conditions from one side of the room to the other.

Two-Position Control

Heat anticipation with two-position control can be used to minimize over-shooting of space temperature caused by the inherent thermal lag of this type of system. Heat anticipation provides time modulation which will cycle the valve every five to ten minutes. "On" periods become progressively shorter as the heating or cooling load becomes smaller and smaller. To accomplish this, the thermostat controlling the space is artificially heated by means of a small resistance type heater whenever the thermostat calls for heat.

This heater artificially warms the thermostat and closes the control valve before the room or zone can overheat because of heat stored in the ceiling panel. This results in more operations of the control valve, which then adds smaller amounts of heat at more frequent intervals. The mass or thermal inertia of the panel smooths out the swings in radiation temperature and provides a more uniform blanket of heat. The graph in Fig 1 illustrates how the addition of heat anticipation reduces the variations in convected air temperature by causing the valve to cycle more often.

Still another advantage of two-position heat anticipation control is its ability to maintain even space temperature control with a minimum of offset, usually considerably less than the throttling range or droop necessary to provide stable control with a proportional system. (High throttling ranges are required with proportional systems because of the large thermal lag inherent in the panel.)

Heating-Only Panels

Either 2-way or 3-way valves can be used to control the individual zones for a heating-only ceiling panel. If 2-way valves are used, it is good practice to use one 3-way valve at the end of each run in order to maintain constant circulation in the hot water line to make hot water immediately available for each controlled zone (see Fig. 2). All 3-way, 2-position valves may be used, if desired, as shown in Fig. 3

Heating-Cooling Panels

If a 3-pipe system is used (one hot water supply line, one chilled water supply line, and one common

Control of Heating-Only Panels

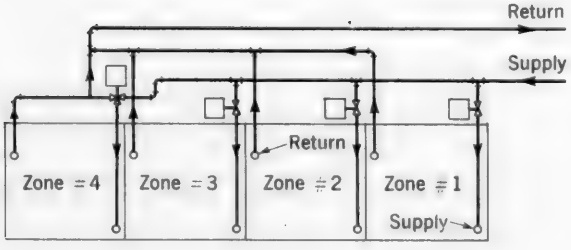


Fig. 2. Controlling individual zones with 2-way valves and room thermostat. One 3-way valve at end of run is recommended.

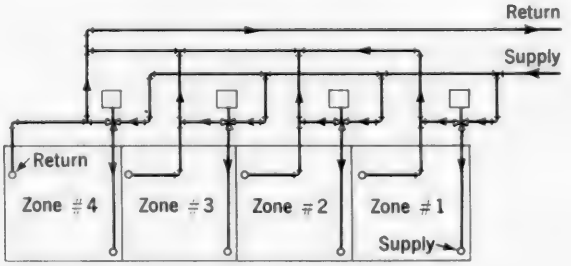


Fig. 3. All 3-way two-position valves can be used as an alternate scheme for zone control.

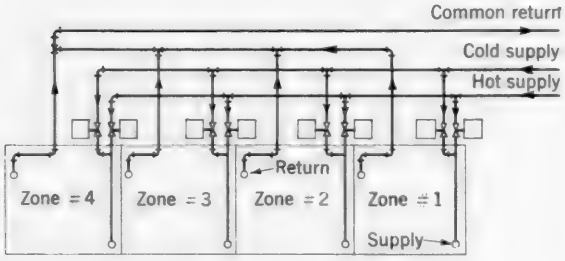


Fig. 4. Three-pipe system for individual zone control using two 2-way valves and 2-stage room thermostat.

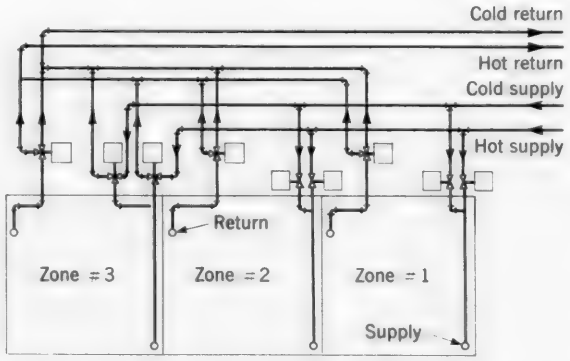


Fig. 5. Two-stage room thermostat four-pipe system controls by means of two 2-way valves and one 3-way diverting valve on return.

return line) it is imperative that only 2-way valves are employed. Do not use a 3-way valve at the end of the run as this would cause continuous flow in both the hot and cold lines and would result in undue mixing of the heated water with the chilled water in the return. See Fig. 4.

In a 4-pipe system, an extra 2-position 3-way valve is needed in the return line from each panel to divert the water to the hot return if the heating supply valve is open. Similarly, this 3-way valve will divert the return water to the chilled water return if the chilled water supply valve is open. This is necessary in order to prevent mixing heating water with chilled water in the return line. See Fig. 5.

The 3-pipe system and 4-pipe system will both provide heating for some of the zones and at the same time provide cooling in other zones. The 4-pipe system will generally be more economical from an operating standpoint than the 3-pipe system, because the 3-way valve in the return from each zone will prevent mixing the hot return with the cold return from a different zone.

Consider Outdoor Temperatures

In order to provide the greatest economy of operation with the greatest comfort, it is desirable to vary the temperature of the hot water supply in inverse ratio with the outdoor temperature (outdoor reset). This control consists of a temperature sensing element outdoors, resetting the control point of an immersion temperature sensing element in the hot water supply line serving the ceiling panels. It normally includes an electronic panel complete with ratio and control point adjustments and an overriding switch.

Usually this control positions a 3-way valve which mixes boiler water with system return water to obtain desired supply water temperature. If the water temperature reset schedule is properly adjusted, there will be very little mixing in the return even with a 3-pipe system. During the intermediate seasons (spring and fall) when uneven load conditions may demand heating in one or more zones and cooling in the other zones, the hot water supply will be at a low temperature, insuring a hot water return near room temperature.

Conclusion

The well engineered layout for a radiant ceiling panel must incorporate the necessary controls in the design stage, preferably of the two-position heat anticipation type for the zone control. This will do much toward assuring the owner of a trouble-free system and a high degree of comfort for the building's occupants.

Check Propeller Fans For Industrial Ventilation

C. J. TRICKLER
Chief Engineer, The New York Blower Company, Chicago, Ill.

Propeller fans and the closely related propeller roof ventilators often provide better ventilation at lower original and operating costs. Here is a guide to help the engineer to decide how and where to use them.

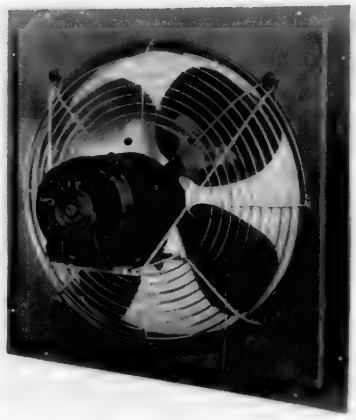


Fig. 1. Wide-bladed, direct-connected, wall-type propeller fan. Wide-blade fan tends to run slower, more quietly, but is less efficient.

Fig. 2. Narrow-bladed fan is a few points more efficient because it lends itself to some form of airfoil cross-section. Used for higher speeds and pressures, where it might be classified as a "semi-axial" fan.

IN the definition of Air Moving and Conditioning Association, "a propeller fan consists of a propeller or disc wheel within a mounting ring or plate. The propeller fan is designed to move air from one closed space to another or from indoors to outdoors or *vice versa* in a wide range of volumes at low pressure."

A propeller fan may be classified several ways, but for our purposes we distinguish between the wall fan and roof exhauster, the wide bladed and narrow bladed (like the airplane propeller), and the direct-drive and belted-drive. Figures 1-4 show these basic types.

When to Choose Propeller Fans

Wherever industrial processes create large volumes of objectionable odors, humidity, heat or non-corrosive fumes, the chances are good that propeller fans can be used to advantage. These applications usually require the movement of large quantities of air at relatively low velocities and are often not well suited to the typical high-velocity hood, duct and centrifugal or axial fan system.

Propeller fans and propeller roof ventilators find their best usage where:

——hot air is "boxed in" by building shape and causes uncomfortable working conditions.

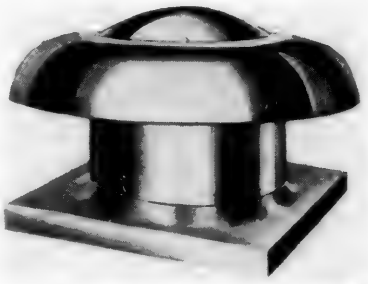


Fig. 3. Direct-connected propeller roof exhauster. Above 24- or 30-inch wheel diameters, most propeller fans are belted to enable high-speed, economical motors to be used with low-speed, quieter blades.

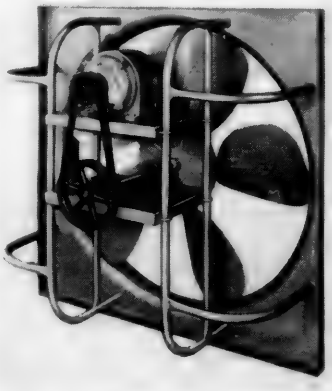
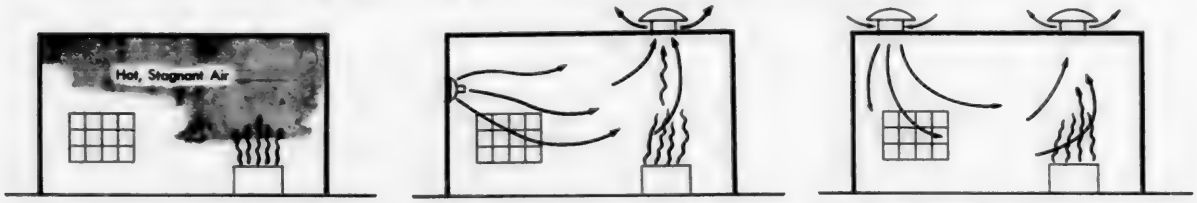


Fig. 4. Wide-bladed, belt-driven, wall-type propeller fan. As a general rule, where required fan static pressure is 1/2 inch or less and noise level is important, the wide-bladed fan is the better choice.

All too often, expensive air conditioning is used to relieve such situations when inexpensive propeller systems would do as well. (See Fig. 5.) This is espe-

FIG. 5. REMOVAL OF HEATED AIR WITH PROPELLER FANS



(a) without ventilation.

(b) with proper wall supply fan and propeller roof exhauster.

(c) with propeller roof supply and exhauster.

cially true where average outside summer air temperature is comfortable.

——moisture generated by manufacturing processes is diffused through a large building space and creates excessive humidity. Since humid air is lighter than dry air, it is often best removed through roof exhausters. Since humidity problems are usually as objectionable in winter as in summer, it is usually necessary to bring replacement air in through a make-up air unit. (See Fig. 6.)

——odors and non-corrosive fumes are generated. They may be treated like the above-mentioned moisture problem, as shown in Fig. 6.

The choice between a wide-blade or narrow-blade propeller fan is one of noise against efficiency. Wide-blade fans tend to run slower and more quietly but do not operate as efficiently as the narrow-blade fans. The narrow-blade fans are usually a few points more efficient because the narrow-width blade lends itself to some form of airfoil cross section. The narrow blade also lends itself to stronger structural designs for higher speeds and pressures. The cross-over point between propeller and axial fans is vague, and narrow-blade, high-speed, high-pressure propeller fans might properly be termed "semi-axial" fans.

As a general rule, where the required fan static pressure is ½ inch or less and noise level is of any consideration at all, the wide-blade fan is the better choice.

Small propeller fans and roof ventilators are generally direct connected. Blade angles, motor sizes and speeds are combined to give a range of available performance ratings adaptable to most needs. Above 24-inch or 30-inch wheel diameters, most propeller fans are belted so that high-speed economical motors can be used with lower running speed and quieter blades.

Performance Characteristics

Whether a propeller fan is mounted into a wall or built into a propeller roof exhauster, its performance characteristics are the same. The choice between wall or roof mounting is merely one of convenience.

Performance characteristics of propeller fans are different from centrifugals. While centrifugal fans use less horsepower as the pressure they operate against is increased, propeller fans tend to use more horsepower. Increasing fan static pressure also increases horsepower. Blocked-tight horsepower may be several times normal operating horsepower.

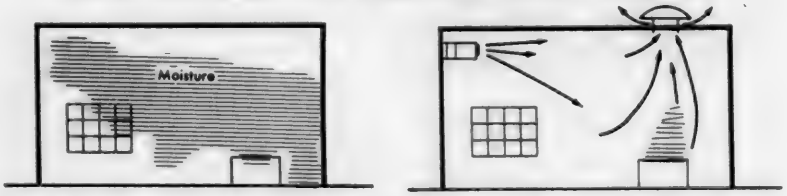
Figure 7 shows typical performance characteristics of propeller fans. Most propeller fans are designed so that their maximum efficiency and best operation occurs near wide open. Propeller fans sometimes exhibit stall characteristics much like the stalling of an airplane in flight. When this occurs, due to excessive system resistance, the fan handles far less than expected air volume, with perhaps a substantial increase in horsepower and usually with more than normal noise.

Application Guide

There are several rules to remember when applying propeller fans or propeller roof ventilators to industrial ventilation problems:

1. *Air must come in before it can go out.* All too often, propeller exhaust fans are applied without considering that the air they exhaust must be replaced. When there are no provisions made to supply replacement air, exhaust fans have to overcome not only the resistance of the exhaust system, but also the resistance incurred in pulling the air into the building through windows, cracks or even

FIG. 6. PROPELLER FANS REMOVING EXCESS HUMIDITY



(a) without ventilation.

(b) with propeller roof exhauster and make-up unit that supplies air at room temperature.

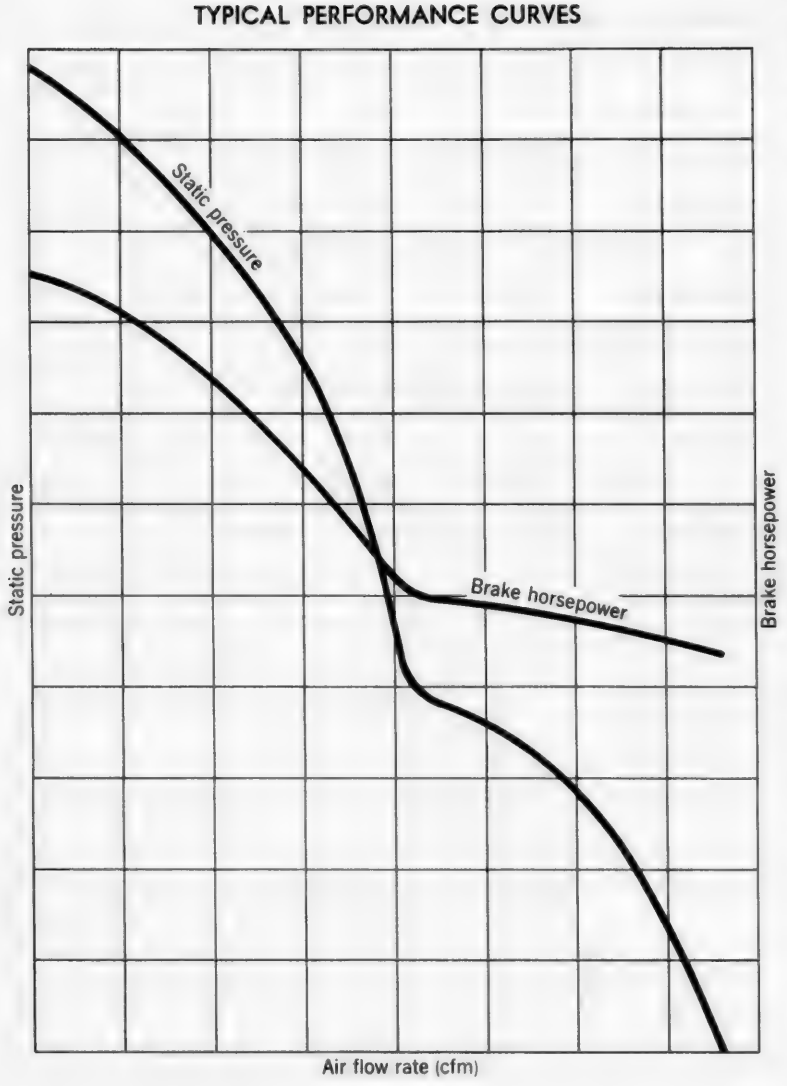


Fig. 7. Most propeller fans, as can be seen from typical curves at left, are designed for maximum efficiency and best operation at near wide-open. Note how horsepower jumps when air flow is throttled.

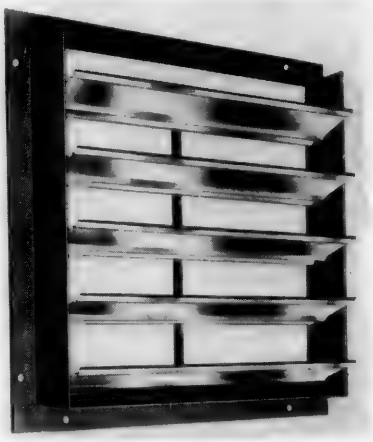


Fig. 8. Automatic louver. It is opened by the force of air flowing through the fan and is suitable for use with exhaust fans.

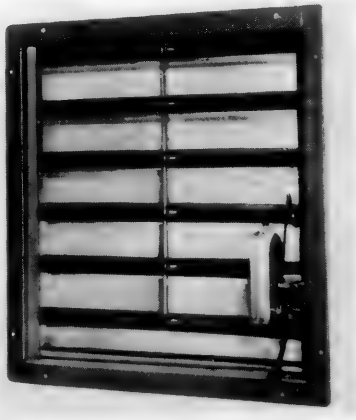


Fig. 9. Motorized louver. It is wired in same circuit with fan motor, opening and closing when fan is turned on and off. Motorized louvers are a must with supply fans.

other, less powerful, exhaust fans. When this situation occurs, the fans exhaust less air, use more horsepower and become noisy. Air must be supplied to the area being ventilated either through large, low-velocity openings or by other fans. If the air can be supplied without heating, it can come into the building through supply propeller fans or supply roof ventilators. If it must be heated it should come in through make-up air units.

2. *Propeller fans are often used with louvers.* These are usually described as "automatic" or "motorized." Automatic louvers are those which are opened by the force of air flowing through the fans. See Fig. 8. Motorized louvers are those which are opened by small motors wired with the fan motors, so that they go on and off together. (See Fig. 9.) Either type may be used with exhaust fans, but supply fans should always have motorized louvers. (Automatic louvers would have to open inwards and would not be weather-proof when shut.)

Automatic louvers are the least expensive and entirely satisfactory for most applications of exhaust fans. They tend to rattle due to wind when not in operation, but this is not a serious disadvantage.

3. *Propeller fans should not be used to exhaust excessively hot air.* Although they are properly used to exhaust uncomfortably warm air from general areas, they should not be used for applications where the air going over the motor is above 120 deg F without consulting the fan manufacturer. Propeller fans rely upon the air drawn over the motor to provide cooling for the motor. If this air is too hot, the motor will run too hot.

4. *Select propeller fans that will be safe* for personnel working near them or servicing them. Wall fans should have guards so that an absent minded laying of the hand on a running fan will not cost fingers.

All fans should be equipped with on-off switches that maintenance workers can padlock to protect themselves. Such devices, although rarely used, can be of critical value when needed to protect the worker from maiming.

5. *Consider the mounting ease of the fans and ventilators.* Square openings are easier to build or cut into walls than are circular openings. Therefore, a fan with a square mounting panel is easier to mount than a round one.

Roof exhausters should have curb caps that permit the units to be set on well proportioned curbs. There is a trend to standardize on 4-inch thick curbs up to 50 inches square outside dimensions, and 6 inches on larger curbs. The curb caps should lap over the sides of the curbs so roofing material can be brought up over them to make a weatherproof installation. Louvers should fit into the same curbs.

Motors and Wiring

Because most propeller fans are selected to utilize the air being drawn over the motors to keep the motors cool, the motor nameplate horsepower and amperage ratings don't have too much significance. It is not out of order to find propeller fan motors selected to operate above their nameplate rating. For example, a motor with a ½-hp rating might operate quite satisfactorily at 0.6 hp. Propeller fans often use totally enclosed, nonventilated motors selected so the operating current will be in excess of that listed on the nameplate of the motor. The motors are kept from operating above their design internal temperature by the cooling effect of the air drawn over the motor. This means that starter heater elements selected on the basis of the nameplate may be too small. Larger elements may need to be used, sized in line with the maximum actual horsepower or watts shown in the fan manufacturer's literature.

Fractional motors used in propeller fans are usually totally enclosed. Open-construction fractional motors are so open that they can eventually become plugged with dirt being drawn through them. This increases motor temperature.

Integral motors of open construction are conventionally designed with far less possibility of dirt plugging the windings. Therefore, most integral-frame, propeller-fan motors are of open construction.

Wherever there is a possibility that explosive fumes may be drawn through the fan, the motor should be of explosion-proof construction.

Sleeve bearings are not desirable on propeller fans because propeller fans are usually relatively inaccessible and often ignored by maintenance personnel. Ball bearings require far less attention.

Sound

Air Moving and Conditioning Association is developing a test code for rating the sound power of fans. When this code is completed, it will provide a uniform method of rating fans and will allow accurate calculation of room sound levels. Until the code is written and manufacturers have had time to use it to rate their products, the user is advised to use the following rules of thumb whenever the quietest possible operation is desired:

1. Select fans with wide blades, low speeds, with not over 7500 fpm blade tip speed.

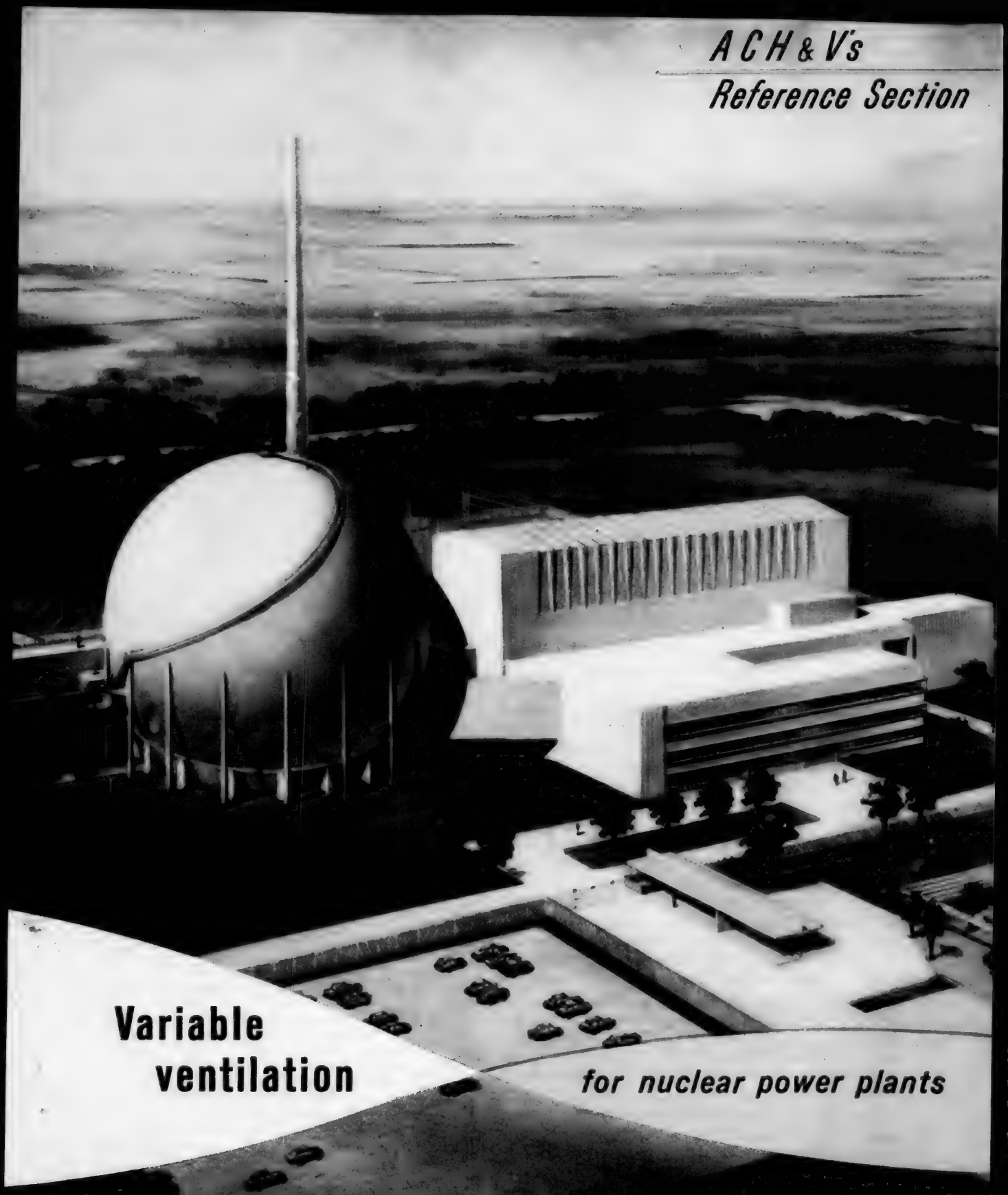
2. Use larger, lower-speed fans wherever there is a choice between larger, slow-speed and smaller, higher-speed fans—for the same capacity.

3. Be sure the motor or motor supports and bearings are resiliently mounted so that electric and mechanical vibrations cannot be transmitted to the fan panel and through it to the supporting structure and building.

4. Follow the manufacturer's recommendation as to the relative quietness of units. Do not attempt to compare one manufacturer's sound ratings to another's because there is as yet no uniform test code, and such comparisons are worse than meaningless.

5. If it is necessary to calculate sound in the area being ventilated, use the ASHRAE *Guide* method to approximate the fan octave sound power levels, and apply the room and system attenuation characteristics to calculate the final values.

ACH&V's
Reference Section



Variable ventilation

for nuclear power plants

by A. J. KAVALE
Ebasco Services

Controlling radiation hazards

NUCLEAR PLANT VENTILATION is enormously different from that in the normal fossil fuel power plants with which we are acquainted. In the fossil fuel plant, the entire structure is treated as a unit since there is no necessity to provide a special treatment for specific areas, with the exception of the control room. Such is not the case with nuclear plants; the nuclear power plant is constructed with distinct area separation calling for varying degrees and types of ventilation.

The nuclear plant must be so arranged that certain areas can be separated so that human traffic can be controlled and monitored after exposure to radiation. The control of human traffic is necessary so that accurate records can be kept of each individual's exposure to radioactive contamination and thus maintain a high level of safety for plant personnel. In general, the plant is composed of five separate areas as follows: Turbine Building, Machine Shop, Access Control Building, Radioactive Waste Building, and Reactor Enclosure.

Whether or not these areas are structurally connected, their treatment from a ventilation standpoint is to consider them separately without dependence on other systems. The author will endeavor to point out the highlights and associated problems involved with the design for each of the areas noted above and shown in the diagram of Fig. 1.

Turbine Building

Architecturally, the external appearance of the

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The power plant that utilizes an atomic reactor in the generation of electricity is slowly encroaching on other forms of power production. It is constructed with distinct area separation calling for varying degrees and types of ventilation. The job of the ventilation engineer is complicated by the necessity of controlling radiation hazards. His recommendations greatly influence the layout of nuclear plant equipment.

. . in nuclear power plants

nuclear plant turbine building is similar to that of the conventional plant. Internally, the structure is divided by a massive concrete wall 4 to 5 feet thick, separating the accessible from the non-accessible areas; as the term implies, the accessible area is that permitting human traffic, while the non-accessible portion is the so-called "hot" space where there is radioactive contamination.

Because of the people, the accessible area air temperatures may be lower than those of the non-accessible area. This is accomplished by introducing all supply air to the accessible areas and then, through the use of supplementary or transfer fans, discharging this air into the non-accessible area from where it is eventually exhausted. The air quantities are those necessary to carry the accessible area heat gain into the non-accessible area. One way of handling this without excessive air quantities is to use evaporative cooling by employing a spray washer. The plant heat gain and maximum air quantity to be introduced into the accessible area of the turbine building will determine whether a one or two bank spray washer is necessary. In general, a single spray washer will suffice under the climatological conditions encountered in the 40 degree or higher latitude zones. In latitudes below 40 degrees, outdoor design factors will determine the washer efficiencies required to offset the plant load, with the atmospheric conditions experienced.

After the supply air has been introduced to the accessible areas and absorbed the heat, it is carried to the non-accessible area by supplementary transfer fans, usually of the axial flow type, which discharge into the non-accessible area through openings in the heavy wall. Dampers are installed in the wall at each point of penetration. These dampers may be of the motor-operated or back-draft type and are provided to insure against a reverse of air flow in the event of a plant shutdown with subsequent pressure build-up in the "hot" area. As indicated in Fig. 2, the author advocates motor-operated dampers of the closed spring return type rather than back-draft dampers to insure positive closure and complete isolation of the two areas. Damper blades should be gasketed with felt, neoprene, or other suitable gasketing material, to prevent leakage.

The main exhaust system removes all the air introduced to the non-accessible area by the transfer fans and discharges it into a remotely-located ventilation stack. In designing this exhaust system, it is necessary to employ a weight of air basis of calculation rather than volume because of the great temperature differential between the supply and return air. Also, it is imperative that there be no positive pressures in the "hot" area, mainly to insure against the exfiltration of contaminated air. It is recommended that aluminum be used in the fabrication of the duct work to minimize the possibility of carry-over of particulates which may result if ducts are constructed of galvanized sheet metal. Finally, it is recommended that a dual exhaust fan arrangement be employed to insure continuous operation.

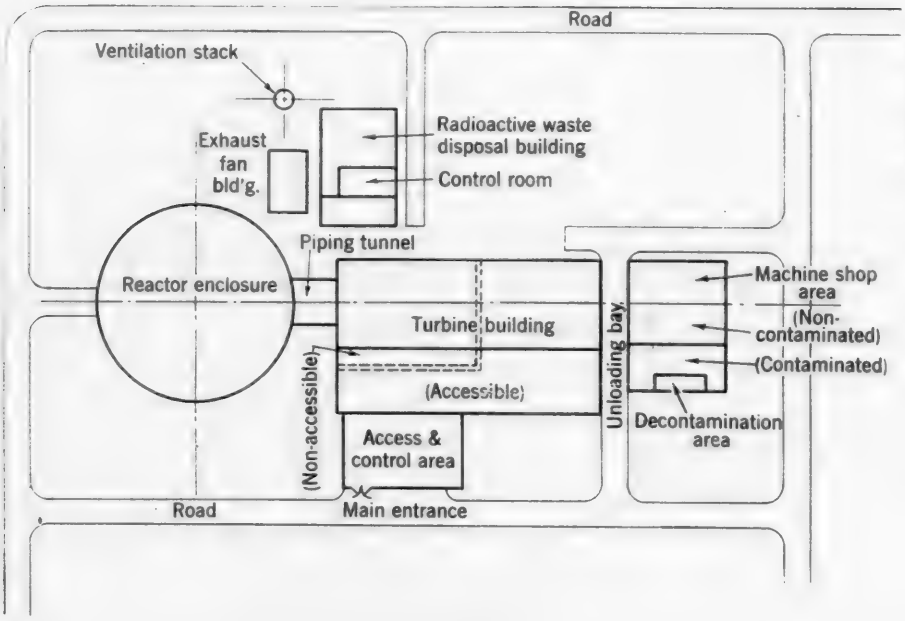

Fig. 1. These are the principal areas of a nuclear power plant. Design considerations for each are covered in the text.

In the earlier days of nuclear power plant design the use of high-efficiency type air filters (CWS standard) was recommended by the Atomic Energy Commission in all exhaust system arrangements to guarantee against contamination carryover in the discharge. However, present thinking is that the level of contamination in the turbine area is well within the permissible level established by AEC and, as a result, high-efficiency filters are no longer included in the turbine building exhaust arrangement.

Normal plant operation results in safe radioactive levels in the ventilation stack discharge. Detection of an abnormal amount of radioactivity in the discharge would necessitate shutdown of the plant to determine its origin. The stack dimensions are predicated on the quantity of air handled and economic factors as to height and discharge velocities. It is recommended the minimum velocities of 3000 ft per min be used to determine the diameter of the stack at the point of discharge. As to height, there appears to be no rule excepting that the top of the stack is to be located sufficiently high above adjacent structures so that the discharge is mixed with and carried off by the prevailing winds.

In regard to the other areas of the over-all plant, it is essential to treat each individually, so that maintenance and repairs do not necessitate a complete system shutdown.

Machine Shop Building

The machine shop building differs from those at conventional plants in that it has separate controlled and non-controlled areas. The non-controlled area would approximate the normal plant machine shop area and is treated in the same manner as far as ventilation is concerned; i.e., ventilation air is supplied and exhausted through power roof ventilators or wall fans. The controlled area requires special treatment because of the contamination possibilities resulting from the machining of metal which has been exposed to radiation. The controlled area is usually subdivided by low partitions or screens which separate the various processes involved in the handling of equipment. The conventional type of shop equipment for handling and machining large plant parts may be found in this area.

It is customary initially to decontaminate the materials to be handled by spraying or washing the surfaces with appropriate solutions. Machining operations are similar to those employed conventionally but the ventilation procedures are different. It is expedient to install an exhaust system which closely follows the machining operation and continuously confines and exhausts the chips which may contain radioactive particles. This can be accomplished by installing individual exhaust branch connections at each machine, with a branch connecting to the exhaust unit. The exhaust branches are topped off with a flexible hose terminating in an expanded snout. This type of exhaust (see Fig. 3) permits flexibility of movement to any specific operation to collect the metal chips, shavings, or metal dust. The over-all system design follows the general standards employed in the design of exhaust systems for conveying metal shavings or dust. The type of exhaust unit usually is of the conventional centrifugal type industrial fan or a dynamic dust separator of adequate capacity to serve several machining operations simultaneously.

Another point of variation from the conventional type of system is that the high-efficiency type of filter is used on the discharge side of the fan unit to insure against the discharge of particulate products directly to the atmosphere.

In the decontamination area, enclosed hoods should be employed in the washing areas to confine contamination. These hoods are duct connected to an individual exhaust system serving only the decontamination area. A minimum velocity of 150 ft per min over the face of the hood is recommended for determining the air quantity to be handled by the exhaust system. The exhaust system incorporates pre-filters plus high-efficiency filters on the suction side of the fan which discharges the spent air to atmosphere. A two-speed fan provides the flexibility of increased capacity when operation dictates. The two-speed feature facilitates over-all exhaust operation; e.g., when the machine shop is inoperative, the decontamination exhaust system should be operated at high speed with air drawn into a supplemental branch, which ordinarily is dampered shut, to provide a balance between the over-all supply and exhaust air quantities (see Fig. 4).

The welding areas have the same arrangement of duct work as the machine shop, with flexible branches terminating in expanded snouts. This arrangement permits movement of the intake to any location for trapping of fumes from the welding process. As shown in Fig. 5, the exhaust system for this area also incorporates pre-filters and high-efficiency filters at suction sides of the fan before discharging air to the atmosphere. It is advantagous to incorporate an additional dampered intake to the duct work which can be used as the main intake when the welding is not in process.

All the exhaust systems serving the controlled areas of the machine shop building usually discharge directly to atmosphere rather than to the ventilating stack. The reasons for this is the distance between the main ventilation stack and the shop building, and the relatively low level of contamination of the equipment. However, if the plant arrangement is such that a relatively short run of exhaust duct would allow its discharge into the main stack, this should be done.

Access Control Building

The name "access control building" is standard nomenclature when referring to the structure which houses the main entry to the plant through which all visitors and employees must pass to gain access to the other areas of the plant.

The access control building is comprised of general offices, utility spaces such as locker rooms, toilets, storage rooms, laundry, laboratories and the main plant control room. The control room is subject to continuous human occupancy even when the plant is shut down. Therefore, it is recommended that this space is served by a separate system. This system should be designed to provide cooling whenever desired; this may occur when outdoor temperatures are in the 50 to 60 deg range, due to the high internal sensible heat load from the lighting and electrical equipment. A built-up system, in essence a tailor-made system, is recommended, and should include two supply fans, one as standby, to insure a continuous and uninterrupted air supply to the control room at all times. Requirements for the handling of return air from this room are similar to those encountered in normal air conditioning systems.

A conventional system of fresh filtered supply air should be provided for the offices and utility spaces. If desirable, provisions for air conditioning can also be added to this system. The advantages derived by including air cooling in the over-all system for other than human comfort are that it results in a reduction of the physical size of the duct work and in the supply fan motor horsepower.

The handling of this exhaust system differs from that of the conventional power plant because of the necessity for governing the air flow pattern from the clean offices (non-radioactive) to the utility spaces and thence to the plant ventilation stack. The air

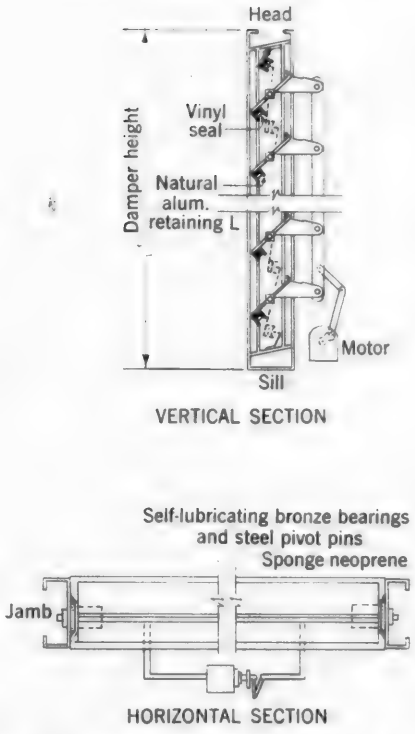

Fig. 2. Detail of damper blades and gasketing discussed under "Turbine Building."

Photos on the cover and page 62 were provided by General Electric Company's news bureau, and show nuclear facilities at Commonwealth Edison's Dresden nuclear power station, located at Morris, Ill.

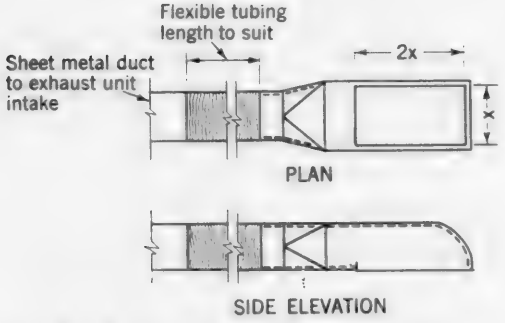

Fig. 3. Detail of flexible exhaust connection and expanded snout used in machine shop building.

flow pattern is practically self-directed when air cooling is furnished, since the utility spaces require make-up air to supplement the normal air supply to meet the recommended rate of ventilation air changes. It has been determined from experience that the exhaust air from the utility spaces can be combined in one common exhaust system, providing that precautionary methods are employed at each of the branches serving the spaces wherein contaminated products are handled. The exhaust air is then carried outside the building to the remote exhaust fans for discharge to the plant ventilation stack.

The advantage of individual treatment of the exhaust air from the laboratories and the laundry space is a matter of economics; i.e., that of eliminating a large bank of absolute type filters in the exhaust fan arrangement. A high-efficiency filter should be located in each duct connection, to the exhaust hoods in the laboratories where contaminated products are analyzed and to the exhaust hoods located over the washing and drying machines in the laundry where contaminated clothing is washed and processed. The exhaust air from all of the remaining spaces, such as locker and toilet rooms, storage spaces, instrument and counting rooms which are not involved in high level contamination processes, does not require filtering before discharge through the stack. Contamination may be present in these rooms but the level of contamination is usually found to be well below the limits defined for human exposure.

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Negative pressures in the utility spaces must be maintained to guarantee against exfiltration of air from these spaces in the event of supply air failure and thus insure against spreading of contamination. The make-up air for the exhaust system in the event of supply air failure could be satisfied by the opening of windows and doors in the offices and the main entry. The exhaust fan discharge may be tied into a common duct serving all the exhaust systems which then conveys the total quantity of exhaust air to the ventilation stack. This duct work arrangement precludes the necessity for making numerous penetrations in the main ventilation stack.

Radioactive Waste Building

The radioactive waste building is usually constructed of concrete and is alien to conventional power plants. It houses various tanks which provide hold-up storage for the by-products and residue from the different cycles in the plant. It is in this building that special ventilation treatment must be employed due to the ever present high level of radioactivity emanating from the by-products of the cycles. The structure is provided with a control room in which all instrument control panels indicating operation of waste products cycles are located. The control room is the only portion of this structure which is located above ground. All other parts of the building are usually below grade, with the various tanks housed in individual cells or enclosures with thick concrete separation walls and roof. Access to these cells is restricted to hatches in the roof of each enclosure.

It is compulsory that the ventilation system be so designed as to insure against exfiltration of contaminated air from any of the cells housing tanks. This may be readily accomplished by the maintenance of a negative pressure in these cells. It is recommended that the ventilation system include both supply and exhaust air systems rather than dependence solely on infiltration of air induced by a mechanical exhaust. Other methods for the introduction of a fresh air supply may be employed, but one of the simplest and most economical is literally to dump the air into the accessible area adjacent to the cells. The accessible area adjacent to the cells usually houses the transfer pumps and is connected to the control room through an enclosed stairwell. This arrangement employs a minimum amount of duct work and insures the desired results. Inlet openings for air to ventilate each of the tank cells should be located with extreme caution to minimize the "shine" effect of radiation.

The openings should never be directed to an area subjected to human traffic. If conditions dictate an opening into a walkway, then the opening should be designed with an offset in the wall to insure against direct exposure. The actual size of this opening is determined solely from the quantity of air to be passed through it; the author's experience is that a system designed on the basis of a velocity through

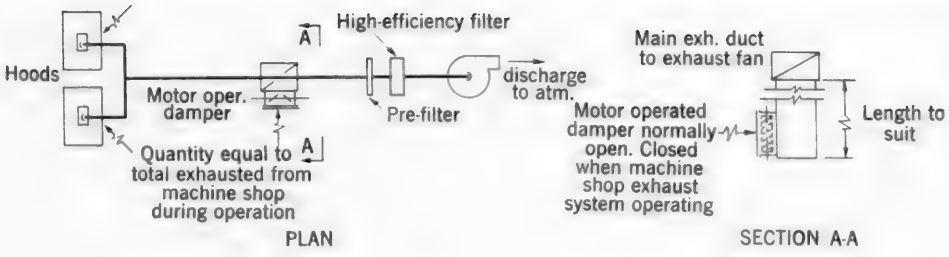


Fig. 4. Supplementary exhaust branch provides air balance in machine shop building.

this opening to maintain a negative pressure of 0.2 inches w.g. has proved to be satisfactory. The exhaust duct work should be arranged to draw air from each individual cell and combine into a common trunk duct to the exhaust fans which are remotely located.

The exhaust fan system consists of two fans of equal capacity, one as standby to insure continuous operation. In this system, we must include high-efficiency filters to nullify radioactive particulate product carry-over to the fan discharge. The author recommends pre-filters of the throwaway type inserted ahead of the high-efficiency filter bank. The inclusion of the throwaway pre-filter is purely an economic benefit which has been found to extend the high-efficiency filter life span by approximately 50%. If the cleanable types of prefilters were used, the problem of handling and cleaning radioactive equipment would have to be resolved.

Reactor Enclosure

The reactor enclosure contains the reactor vessel and is commonly spheroid or cylindrically shaped. The reactor vessel may be compared to the boiler of a conventional power plant; it is here that steam is formed by the heat of atomic reaction. This steam drives the turbine and thus generates power.

The generation of power by this method presents a radiation problem which complicates the ventilation of this structure. It must be remembered that this type of power generation is still in its infancy, and as a result, the concern of the designer about safety tends to make him overdesign. The ventilation systems for the reactor enclosure are where we encounter new treatment because of the strong possibility of handling contaminated air. It is essential that added precautions be taken and incorporated in the handling of all exhaust systems, both internal and external to the enclosure.

The reactor enclosure is normally constructed of heavy steel plates forming a shell which envelops huge masses of concrete which house numerous individual compartments. The compartmentation of the concrete structures involves thick walls so made for both structural and shielding purposes. The compartments are used as heat transfer equipment rooms, pump rooms, instrument rooms, and for other purposes.

The ventilation system for the reactor enclosure is primarily composed of four main systems—the supply system, two primary interior systems, and an exhaust system.

The supply system furnishes fresh filtered air to the enclosure, the quantity of supply air being determined by the number of compartments requiring fresh air. As a result, the supply air system is of a practical size, which would not be the case if a rate of air change had been calculated for the whole sphere, with resulting massive air movement. Because of the nature of the nuclear cycle, refueling periods occur during which an increased air supply is necessitated to satisfy increased activity and specific requirements that do not occur during normal operation. Consequently, the supply system must be designed to furnish a certain quantity during normal reactor operation and an increased quantity during the refueling operation.

As indicated by Fig. 6, the supply system components are located externally to the enclosure and should include two fans. One fan is a standby during normal operation. Fresh filtered air is supplied to the enclosure through duct work which must be designed for outdoor exposure. A distinctive feature incorporated in the duct work, which is not found in standard ventilation systems, is a butterfly-type shut-off valve, either pneumatically or hydraulically operated. This valve should be electrically connected to the fan motor starter to insure closing when fan is down. Frequently, two automatic type valves are placed in series to insure shut-off, but it is the author's opinion that one valve of the automatic type with a similar valve of manual type, placed in series, will suffice.

The actual duct size is usually a compromise be-

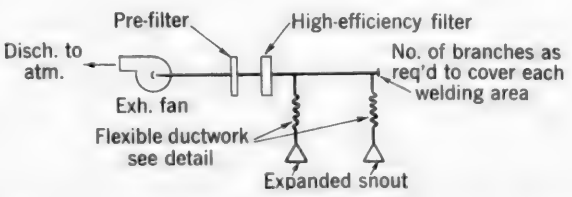


Fig. 5. Welding areas use this type of exhaust system. Flexible connection is detailed in Fig. 3.

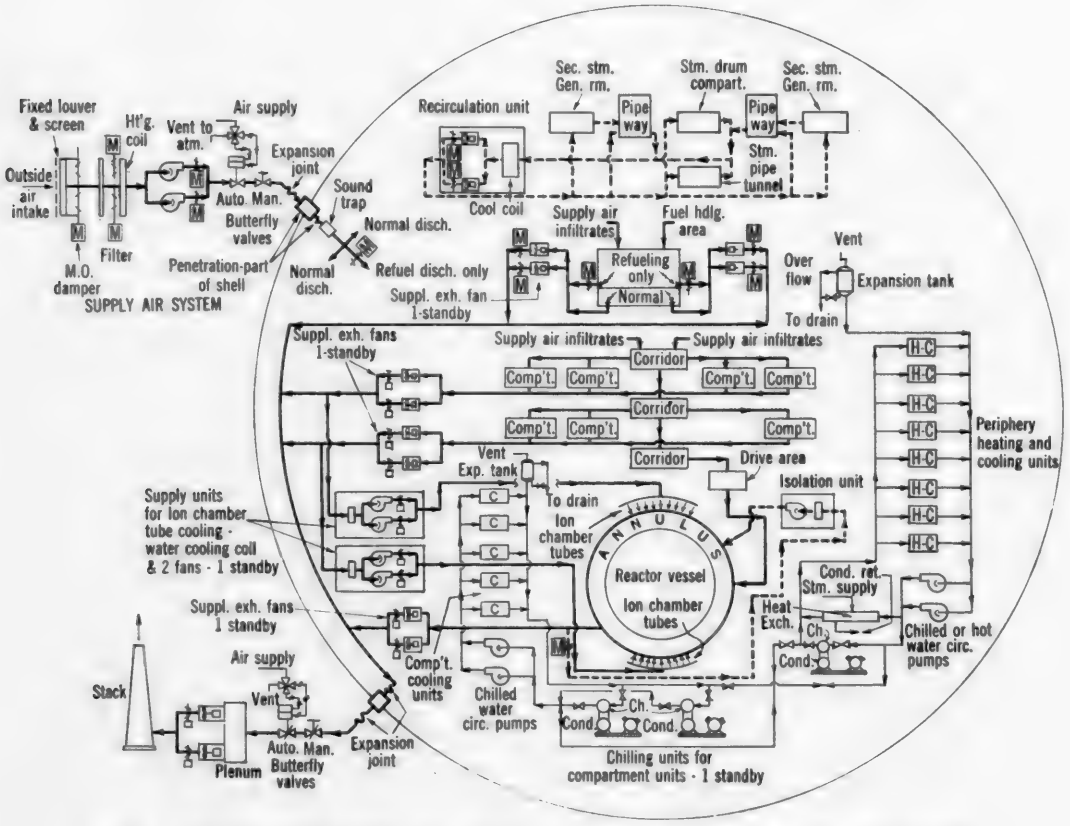


Fig. 6. The ventilation system for the reactor enclosure consists of four main systems — the supply system, two primary interior systems, and an exhaust system. The exhaust system is the most complex one serving this enclosure.

tween theoretical requirements (based on standard ventilation practice for air velocities) and structural factors affecting economy in fabrication. This compromise increases the inlet air velocity resulting in the necessity for checking the noise level of the supply system to ascertain whether a sound trap should be incorporated in the duct work, necessary in most installations to get satisfactory noise reduction.

The supply system is normally a ventilation system with a heating coil included to temper the air during cold weather. If desired, and this is simply a predilection of the design engineer, a spray washer may be included in the system arrangement. The advantage of utilizing a washer in the system is twofold: it provides additional air filtration and, most important, it reduces the cooling load to be handled by the refrigeration equipment located inside the enclosure. In any case, it is recommended that a bank of filters be incorporated at the intake. The filters may be of the throwaway or cleanable type depending on individual preference, with the author leaning to the cleanable type filters because of the economic advantage over the long run. The supply air is discharged into the enclosure at the main operating level through standard grilles, and flows to various spaces, induced by the negative pressure created through either the main exhaust system or supplemental exhaust fans.

The two primary interior systems (also shown in Fig. 6) are termed the periphery and the compartment systems. Both these systems require refrigeration since they must handle the solar and transmission heat loads as well as the heat loads generated by process equipment and motors.

The function of the periphery system is to offset the solar and transmission loads, lighting load, and the heat from motors associated with the installation of cooling equipment. This system usually requires the placement of air conditioning units on the main operating level, around the periphery of the enclosure, to perform this cooling requirement. The air conditioning units are of the low pressure central station type with a filter box, water cooling coil and a fan section, to recirculate the ambient air for handling the cooling requirements. Chilled water for the water cooling coil is supplied in a closed loop from a water chilling unit located within the enclosure to facilitate piping arrangement. The water chilling unit must of

necessity be of the water cooled condenser type with condensing water supplied from a service water loop.

The compartment system function is to cool the various compartments of cubicles which are located throughout the lower levels of the enclosure and which contain instrument gages or recording devices associated with the operating cycle. This system employs air conditioning units (generally of the suspended type) with fan section and water cooling coils which are located within the spaces served. The unit recirculates the compartment air to provide the necessary cooling to make the space habitable and allow proper instrumentation operation. Chilled water for these water coils is supplied in a separate closed loop from another water chilling unit. Because of the importance of maintaining required temperatures, it is suggested that a standby water chilling unit be incorporated in this design and piping arrangement, thus insuring continued chilled water supply to the units. The author suggests a cross connection of the piping between the water chilling units serving the periphery system and the compartment system which would provide a standby unit for both systems.

The exhaust system is the most complex one serving the reactor enclosure. The complexity results from the many compartments which are located throughout the enclosure that must be kept fresh by the passage of ventilating air. As seen in Fig. 6, the over-all exhaust arrangement is allied to the compartment system because, in the majority of cases, they serve the same spaces. It must be remembered that each cubicle, being an entity in itself, requires fresh ventilating air despite the presence of an air conditioning unit within the space to serve as a heat dissipator.

Although it is theoretically possible to connect each compartment exhaust to a common duct for conveying the exhaust air to the main exhaust fans, which are externally located, the author strongly recommends the use of supplementary exhaust fans. The over-all balancing of a complex system drawing air from so many diversely located sources by a single exhaust fan is practically impossible. The supplemental fans serve as boosters and facilitate balancing of the different areas.

There are a number of spaces which are not accessible during operation but contain heat producing equipment which necessarily requires cooling. Here we have a choice between furnishing individual cooling units or a central cooling system with air ducted to each area involved. This choice is a matter of personal preference but the author leans to a central cooling system with cool air conveyed to the specific areas through duct work and returned to the central system for cooling, thus effecting continual recirculation. This preference is based primarily on the ability of the recirculating system to utilize available service water at moderate temperatures without need to resort to refrigeration. This is contingent on the higher temperatures which may be maintained in these nonaccessible areas, specifically up to 150 deg, effecting adequate cooling with water inlet temperature up to 85 deg. The recirculating system generally serves spaces such as secondary steam generator rooms, pipeway areas, steam drum compartment, and the steam pipe tunnel area which is a continuation of a

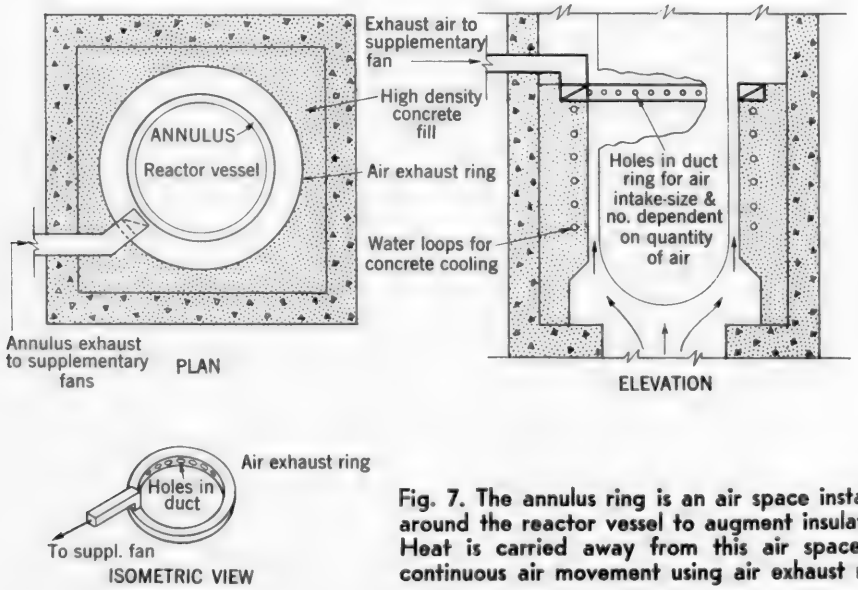


Fig. 7. The annulus ring is an air space installed around the reactor vessel to augment insulation. Heat is carried away from this air space by continuous air movement using air exhaust ring.

tunnel space housing the main piping between the reactor enclosure and turbine building.

The reactor vessel is heavily insulated to confine the heat generated in the atomic reaction process. In conjunction with the insulation around the vessel, an annulus ring is installed around the vessel to serve as an air space to augment insulation and also to furnish partial protection against excessive heat violating the integrity of the heavy concrete walls surrounding the vessel. One of the most efficient methods of carrying off heat between any two surfaces is the continuous passage of air. This theory is fully employed in the treatment of the air space between the reactor vessel and the annulus ring. The continuous stream of air is drawn through this air space by a supplementary exhaust fan connected to a circular duct, with numerous intake openings around the annulus ring (see Fig. 7). The air is drawn up from the area below the vessel. The fan serves to create a negative pressure in the annulus air space and thus insures continuous air movement. This air is then discharged into the main exhaust system duct work, where it is conveyed to the remotely located main exhaust fans for discharge into the common duct connected to the ventilation stack.

A measuring system that determines the power production rate and rate of fission in the core of the reactor vessel consists of measuring devices enclosed in tubing which surrounds the reactor vessel. These devices are positioned in the tubing by a pulley arrangement. To insure proper operation of the enclosed instruments, it is essential that the temperature in the tubes be maintained at a maximum of 140 deg. This is accomplished through the use of a supplementary supply fan system and a water cooling coil to furnish cooled air to each of the ion tubes. This air is supplied to one end of the tubes and permitted to exfiltrate from the other end of the tubes into the area below the annulus ring. This accomplishes a dual purpose—cooling the tubes and furnishing additional air for the reactor annulus system.

As noted previously, the main exhaust system consists of the various supplemental exhaust fans discharging air into the main duct which then conveys the air to the main exhaust fans. Another of the supplemental systems which contribute to the main exhaust serves the fuel handling area. This system is of prime importance because of the absolute necessity for maintaining a continuous supply of fresh air to this area which is subjected to heavy human traffic during the process of refueling. The fuel handling area system is provided with a two-speed exhaust fan which is regulated to operate at low speed during normal operation and at high speed during refueling. An exhaust system is necessary in this area to insure clean air flow from the enclosure atmosphere into the fuel handling area. The two-speed feature of the fan permits the air quantity to be increased during refueling operations, a period of high occupancy.

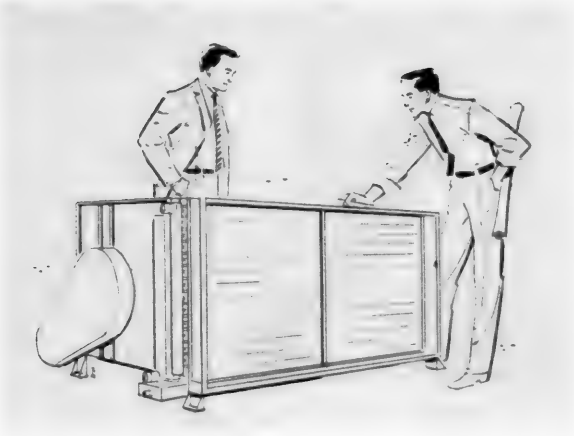
In addition to the time when power is being generated and the various ventilating systems are in operation, it is equally essential to make provision for the time when the power generating cycle is shut down due to a nuclear accident. When this occurs, the reactor enclosure is isolated and, consequently, the ventilation systems are shut down. The significance of this provision is that it furnishes the necessary safeguard against the possibility of permanent damage to the reactor enclosure due to high temperatures. This may be accomplished by incorporating an isolation unit which consists of a supply fan and a water cooling coil in the design arrangement (refer to Fig. 6). When isolation occurs, all ventilation air systems become inoperative and, at that time, the isolation unit may be manually activated.

The isolation unit functions to supply cooled air to the reactor annulus. Through a loop type duct work system, the air may be recirculated to effect a degree of cooling around the reactor thus insuring against damage to the shielding concrete. Because of the overlapping duty of this system with that of the reactor annulus exhaust system, a common duct to serve both systems may be utilized. One precaution to be observed when a common duct system is employed is the proper location of electrically operated control dampers to guarantee air flow in the desired direction. The source of water for the cooling coil should be taken from a water loop which is active at the time of shutdown, namely the cooling water loop serving the coils buried in the concrete walls surrounding the vessels.

Exhaust Fan Building

It may be helpful to add a note or two about the exhaust fan building which has been referred to frequently in this article. Although this structure is not generally encountered in normal plants, it is a significant part of nuclear plants. Seen in Fig. 1, this building houses the main exhaust fans which are a functional part of the systems associated with the various areas. The exhaust systems are individually collected in this structure to facilitate handling of the collective discharge to the stack and, besides, it is a convenient central point to monitor the air handled. Since the exhaust systems handle air which may be contaminated, it is recommended that each exhaust system be serviced with a radiation monitor. The advantage of a monitor on each system is that it enables an operator to pin-point the source of any high radiation level discharge.

Exhausts from each system are united in one common duct which is then directly connected to the ventilation stack. In conjunction with proper arrangement planning, the ventilation stack should be located close to the exhaust fan building so that the conveying distance of the common exhaust duct may be as short as possible.



Ratings for coils, as with fans, are based on standard air. Here is how to select a coil for non-standard conditions.

COIL SELECTION for ALTITUDE

ALAN S. DECKER

Vice-President, Engineering, Dunham-Bush, Inc., West Hartford, Conn.

AS pointed out by C. J. Trickler in "Fan Selection for Heat and Altitude" (AIR-CONDITIONING, HEATING and VENTILATING, June 1961), fans are usually rated on the basis of standard air. Heating and cooling coils are rated on a similar basis. Therefore, the consulting engineer and contractor are faced with the same selection problems for fan-coil type equipment such as central station air-conditioning units and heating and ventilating units. The purpose of this article is to provide a practical means to make such selections.

Since fan selection is an integral part of this problem, a summary of the selection method given by Trickler is in order here.

Density Factor

Mechanical specifications should state actual *cfm* and static pressure required *at the altitude at which the fan will operate.* An equivalent *sp* is determined by dividing actual *sp* by relative air density, (ratio of densities of air at required altitude to standard air). See Table 1 for these correction factors. With actual *cfm* and equivalent *sp,* correct fan and fan speed are selected directly from the catalog. Brake horsepower given in the catalog must be corrected by multiplying by the same relative density factor, since the lower weight of air being moved requires less power.

This lower weight of air for the same *cfm* constitutes the major effect on coil performance at higher altitudes. Since air temperature change is inversely proportional to the weight of air flowing, and air-side heat transfer coefficient is a function of mass velocity, a correction is needed which accounts for the change in mass flow.

At this point it is helpful to classify the application problem by type of equipment to be used: In the first case, for central station air-conditioning units, heating and ventilating units, and any similar units where rating data are available at a variety of air flows, a direct and theortically correct approach can be used. For this type of unit, the rule is *multiply* cfm *required at the altitude by the relative density factor* (Col. 2, Table 1). Using this equivalent *cfm,* coil selection is made directly from the catalog at the given air and cooling (or heating) medium temperature.

Note that static presure drop through the unit can be most accurately determined by dividing pressure drop at the equivalent *cfm* used for coil selection by the relative density factor. (The method suggested by Trickler, *i.e.* multiply the pressure drop at the

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EXAMPLE 1

Select a combination cooling and steam heating central station unit to deliver 18,000 cfm at 6,000-ft altitude against external static pressure of ⅞ inch at 6,000-ft altitude. Cooling capacity to be 480,000 Btuh with air entering at 80 db and 67wb, using direct-expansion coil operating at 40-deg suction temperature. Heating capacity to be 650,000 Btuh with 2 psig steam and 70-deg return-air temperature.

It appears that a nominal 18,000-cfm (Model ABC) unit will be ample, but coils must be selected first to establish total static pressure at which the fan will operate. The equivalent *cfm* for coil selection is 18,000 × 0.801 = 14,400 *cfm*. Coil face area for a Model ABC unit is 36 sq ft. Capacity required is 480,000/(12,000 × 36) = 1.11 tons per sq ft. A four-row DX coil will provide 1.23 tons per sq ft and will be ample.

Heating capacity must be corrected by the relative heating effect of steam at the altitude. From Table 1, capacity is 650,000/0.931 = 699,000 Btu. Capacity per sq ft of face area is 699,000/36 = 19,400 Btu per sq ft. From the catalog, at 2 psig and 70 deg, and face velocity of (the equivalent) 14,400 cfm, or 14,400/36 = 400 fpm, it will be seen that a 1-row coil with 8 fins per inch should be selected. This coil has a capacity of 20,780 Btu per sq ft.

To determine internal static pressure loss, for face velocity of 400 fpm, the catalog is consulted. We find:

2-inch, high-velocity filters	0.049 in w.c.
4-row cooling coil	0.160
1-row 8-inch steam coil	0.050
Apparent internal *sp*	0.259 in w.c.
Actual internal *sp* loss = 0.259/0.801 =	0.32
Actual external static pressure	0.875
Total static pressure	1.195
Equivalent *sp* = 1.195/0.801 =	1.48 in w.c.

Entering the catalog's fan capacity tables with equivalent total static pressure of 1.48 and actual 18,000 cfm, a Model ABC unit is seen to require a fan speed of 560 rpm. Published brake horsepower is 5.9; thus *bhp* required at 8,000 ft is 5.9 × 0.801 = 4.74. A 5-hp motor is selected.

actual *cfm* by the relative density factor, gives nearly the same result, since the pressure drop is almost directly proportional to cfm^2.)

Steam Coils

This method is applicable to all types of air coils, with the exception of steam coils. In the case of steam heating coils, most frequently, the steam pressure is specified. At normal sea level conditions this specified pressure corresponds to a particular steam temperature. For example, 2 psig at sea level corresponds to 218 deg F. However, at 10,000 ft, 2 psig corresponds only to about 200-deg steam.

To solve this problem directly, specify desired steam *temperature* and select the boiler to operate at a somewhat higher pressure to deliver this temperature. For example, if 218-deg steam is desired at 10,000-ft altitude, the boiler would have to deliver steam at about 6.6 psig. In this case, the steam coil required can be selected from the catalog, using the 2-psig ratings (after establishing equivalent *cfm* as above).

Since the above procedure will not always be followed in the specification writing, it is desirable to have a capacity correction factor for steam coils to permit direct selection. In Table 1 we have given the *relative heating effect* for 2-psig steam at various altitudes. In addition to determining equivalent *cfm* as above, required heating capacity is divided by the relative heating effect and the coil is selected from the catalog based on equivalent *cfm* and equivalent *Btuh*.

Relative heating effect is obtained from:

$$h = (T_s - T_a)/(T_r - T_a)$$

where

h = Relative heating effect,

T_s = Saturated steam temperature at specified gage pressure and altitude,

T_r = Saturated steam temperature at rated condition, and

T_a = Entering air temperature.

Therefore, for specified steam pressures other than 2 psig, this

formula can be used to determine the relative heating effect at any altitude.

Although the foregoing coil selection method is theoretically sound for all coils, it is not easily applied to fixed-speed equipment and direct-drive equipment such as fan-coil room air conditioners, propeller fan unit heaters and remote air-cooled condensers. The problem is that rating data for this type equipment is usually prepared only for a single *cfm* condition. The method of selecting this equipment for altitude is not accurate over an extreme range of conditions, but if specified *cfm* and capacity are chosen so that leaving air conditions are not extreme, the error introduced is not appreciable. (For example, 50-deg leaving an air-conditioning coil or 160-deg leaving a heating coil would not be considered extreme.)

Within these limits, the combination of correction factors needed for the change in mean temperature difference and heat transfer coefficient is so nearly equal to the relative air density that this factor can be conveniently used. To select the coil, divide the specified capacity by the relative air density factor from Table 1 and select directly from the catalog at the specified *cfm*. For steam coils, it is necessary to divide also by the relative heating effect factor.

Required fan motor horsepower drops, but no advantage can be taken in this case due to the cost of a special motor. This drop in power can cause difficulties, however, in the speed control on small, shaded-pole or split-capacitor motors. When such units are offered for multi-speed operation, the speed control (reactor or tapped winding) is determined for the specific application. Any reduction in the power required at high speed tends to make speed control less effective. It is possible, under extreme conditions, for the second and third speeds to be almost equal to the high speed at high altitude. The only solution to this is a special reactor or special motor.

Examples 1 and 2 should suffice to crystallize the use of the two methods given.

TABLE 1 — CORRECTIONS FOR ALTITUDE

Altitude, Feet	Relative Air Density	Relative Heating Effect*
0	1.000	1.000
1000	0.964	0.988
2000	0.930	0.975
3000	0.896	0.965
4000	0.864	0.956
5000	0.832	0.943
6000	0.801	0.931
7000	0.772	0.918
8000	0.743	0.905
9000	0.714	0.896
10000	0.688	0.884

* For 2-psig steam.

EXAMPLE II

Select a fan-coil room air conditioner to deliver 200 cfm at 10,000-ft altitude, free discharge. Cooling capacity is to be 6,000 Btuh with air entering at 80 db, 67 wb and with 45-deg entering water. Heating capacity to be 12,000 Btuh with 70-deg air entering and 160-deg water. Water flow rate to be 1.5 gpm for each condition.

From the fan-coil manufacturer's catalog, it is found that Model XYZ meets all these conditions *at sea level*. However, when we apply the relative air density factor of 0.688 from Table 1 for an altitude of 10,000 ft, equivalent *required* cooling capacity is

$$6{,}000 / 0.688 = 8{,}750 \text{ Btuh}$$

and equivalent *required* heating capacity is

$$12{,}000 / 0.688 = 17{,}500 \text{ Btuh.}$$

Therefore, it is necessary to use a Model XYW, the next higher-capacity unit available, whose capacity at sea level is 9,900 Btuh of cooling and 18,600 Btuh of heating. *Actual* cooling capacity will then be

$$9{,}900 \times 0.688 = 6{,}800 \text{ Btuh}$$

and *actual* heating capacity will be

$$18{,}600 \times 0.688 = 12{,}800 \text{ Btuh.}$$

Since these actual capacities are quite close to the originally specified capacities, loss of speed control may not be important. However, if the capacities had been considerably in excess of the specified, or if for any other reason it were important to have good speed reduction, the manufacturer would have to be consulted regarding special motor control.

Note that *cfm* delivered by the unit selected is actually 330 cfm compared to the 200 specified; in direct-drive equipment with matched coils, such as this, there is no alternative.

Sizing and Locating the Pump

In Air Conditioning Applications

In this article, the author shows, by example, how to size a centrifugal pump and goes on to show how to place the pump, including a discussion of series, parallel, and variable system operation.

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MOST PUMPING SYSTEMS have a basic system head—that is, the vertical distance between "where it is going." This head, called a static head, exerts a constant load on the pump for every gallon pumped, regardless of the rest of the system. To be precise, static head can be described as the vertical distance between the free level of the source of supply and the point of free discharge or the level of the free surface of the discharge liquid. Examination of Fig. 1 will illustrate this distinction.

Once the system is laid out, nothing will change the static head unless the level of the discharge or supply is changed. The pump can be moved anywhere in the system. You can repipe the system. You can drain the system and refill it with an entirely different liquid with a different specific gravity and viscosity. None of these changes the static head measured in feet of liquid pumped.

Added to the static head in each system are friction losses, sometimes called dynamic losses, that vary with the flow. These losses depend on the liquid being pumped and on the viscosity, pipe size, pipe length, and pipe material, number and type of fittings, flanges and connections, and, most important, rate of flow. These losses also vary with time, for pipes become clogged with sediment and rust. All these friction losses can be closely calculated and plotted into what is known as a system curve. This curve added to the static head produces a system-head curve, as shown in Fig. 2, that helps determine the size of pump required.

Perhaps an example (see Fig. 3) will best serve to illustrate the method of determining the system-head curve. At the same time, this problem will point out the significance of properly sized piping.

Example

An industrial plant needs a pump to lift 200 gpm of water at 72 deg F from a sump to a tank on the roof. The tank has 10 psi air pressure in it to get better flow throughout the distribution system. Tank

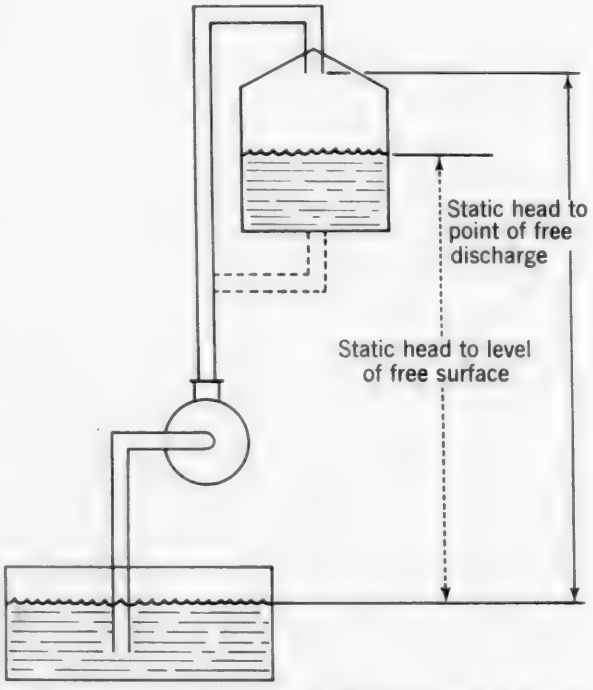


Fig. 1. The static head on the discharge side is either of the two cases illustrated.

is 58 ft above the pump and the pump is 4 ft above the water level in the sump. Discharge pipe is 400 ft long and contains four standard elbows, one check valve and one gate valve. Suction pipe is 25 ft long containing 2 elbows and a foot valve.

A substantial amount of 2½-inch pipe is being purchased for use elsewhere on the job. If this pipe can be used for the discharge line, savings can be realized by taking advantage of quantity discount. For the suction line, assume 4-inch pipe, and also calculate for 4-inch pipe in the discharge.

Step 1: Calculate equivalent pipe length *(epl)* in both discharge and suction sides of the system. Calculate separately as it is common to use different size piping on the two sides. This makes it convenient to compare the effects of various size discharge piping. Equivalent pipe length for various connections can be obtained from Table 1.

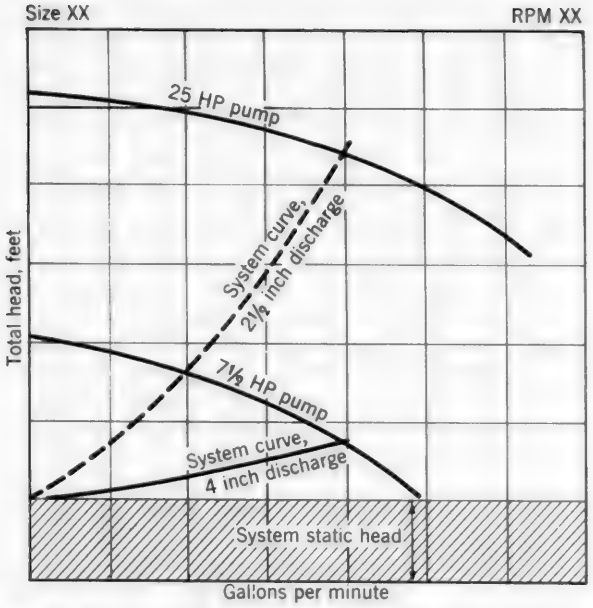


Fig. 2. System curves for a 2½ inch pipe system and a 4 inch pipe for the same job.

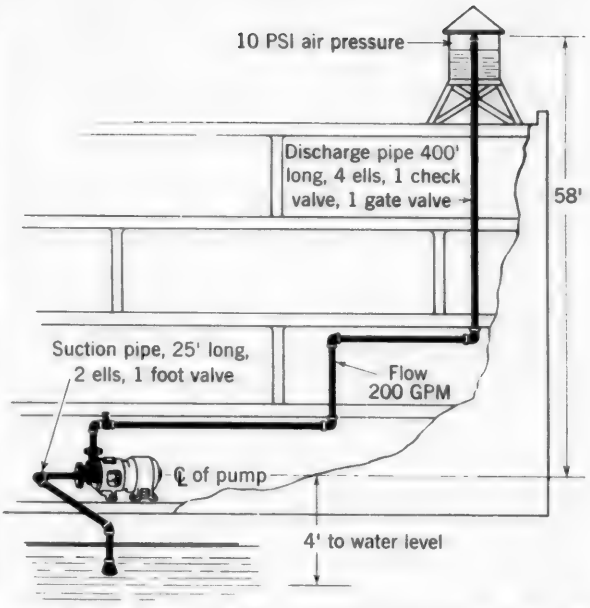

10 PSI air pressure
Discharge pipe 400' long, 4 ells, 1 check valve, 1 gate valve
58'
Suction pipe, 25' long, 2 ells, 1 foot valve
Flow 200 GPM
℄ of pump
4' to water level

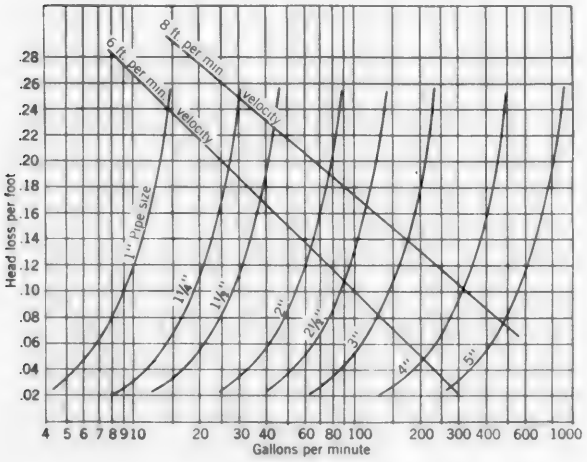
Fig. 3. Illustration of the arrangement for which the discharge and suction piping are sized as an example.

TABLE I — FRICTION LOSSES IN SCREWED PIPE FITTINGS

(Values are in equivalent length of standard pipe, feet)

Nominal Pipe Size, Inches	Actual Inside Diameter, Inches	Gate Valve Full Open	Long-Sweep Elbow or on Run of Standard Tee	Medium Sweep Elbow or on Run of Tee Reduced in Size ¼	Standard Elbow or on Run of Tee Reduced in Size ½	Angle Valve Full Open	Close Return Bend	Tee Through Side Outlet	Globe Valve Full Open	Check Valve (Approx.—varies with type & make)
¾	0.824	0.44	1.4	1.8	2.1	11.5	5.1	4.2	23.1	5.7
1	1.049	0.56	1.8	2.4	2.6	14.7	6.5	5.3	29.4	7.7
1½	1.61	0.86	2.7	3.6	4.1	22.6	9.9	8.1	45.2	13.0
2	2.06	1.10	3.5	4.6	5.2	29	12.8	10.4	58	18.0
2½	2.46	1.32	4.2	5.5	6.2	35	15.2	12.4	69	22.0
3	3.06	1.6	5.2	6.9	7.7	43	18.9	15.5	86	30.0
4	4.026	2.1	6.8	9.0	10.2	57	24.8	20.3	113.00	41.0
5	5.047	2.7	8.5	11.4	12.7	71	31	25.4	142.00	55.0
6	6.065	3.2	10.2	13.6	15.3	85	37	31	170.00	65.0

Note: Foot valve loss is zero, provided its area is 150% of suction pipe.



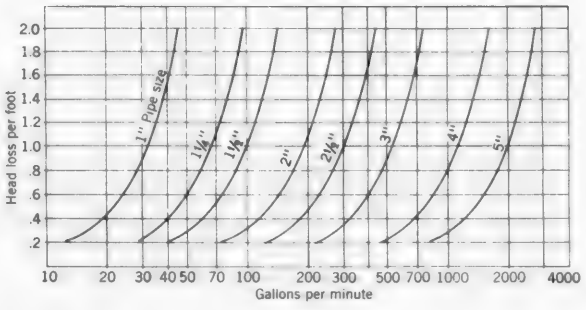


Fig. 4. At left, friction head losses, old standard steel pipe, for low head losses. Fig. 5. Above, data for high head losses.

Friction Losses	*Solution A* 2½-in discharge pipe 4-in suction pipe	*Solution B* 4-in discharge pipe 4-in suction pipe
Discharge		
Length of discharge pipe, feet	400	400
4 ells, epl	4 × 6.2 = 24.8	4 × 10.2 = 40.8
1 check valve, epl	1 × 22 = 22	1 × 41 = 41
1 gate valve, epl	1 × 1.32 = 1.3	1 × 2.1 = 2.1
Discharge epl, feet	448.1	483.9
Suction Lift		
Length of suction pipe	25	25
2 ells, epl	2 × 10.2 = 20.4	2 × 10.2 = 20.4
Foot valve, epl	0	0
Suction epl, feet	45.4	45.4
Static Head		
Vertical distance, pump to tank, feet	58	58
Tank pressure	10 psi × 2.31 = 23.1	23.1
Static suction lift	4	4
Total static head, feet	85.1	85.1

Step 2: Multiply total *epl* times head loss per foot in the particular size pipe (2½-inch and 4-inch) at the required delivery rate, 200 gpm. Head loss for the 4-inch pipe is obtained from Fig. 4, that for the 2½-inch pipe from Fig. 5. Read up from the flow until the curve for the size pipe in question is intersected and read the head loss on vertical scale. The head loss obtained is 0.463 for the 2½-inch pipe and 0.043 for the 4-inch. Then, Friction losses = Total *epl* × head loss per ft.

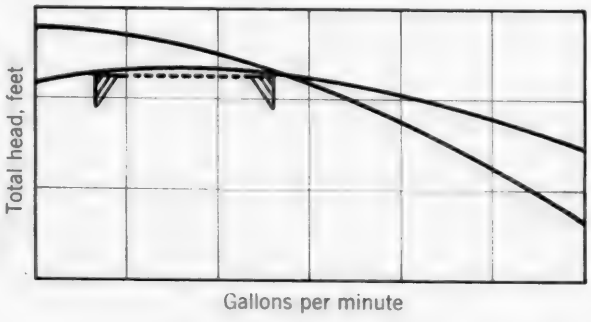


Fig. 6. A drooping pump curve can intersect a given head at two points, resulting in hunting.

	2½-in Discharge	*4-in Discharge*
Discharge	448.1 × 0.463 = 207.5	483.9 × 0.043 = 20.8
Suction (4-in, both cases)	45.4 × 0.043 =	45.4 × 0.043 = 2.0
Total friction losses	209.5	22.8

Step 3: Add total friction losses to static head. Result is total head to be overcome by pump:

Total friction losses	209.5	22.8
Static head	85.1	85.1
Total head	294.6	107.9

Armed with the total head figures of 294.6 and 107.9 from the two alternate solutions shown in Fig. 3 and the required delivery of 200 gpm, enter either a checkerboard selection chart or an area coverage chart to select the proper pump to operate *at these precise conditions.* Either listing will show that a 7½-horsepower unit will supply 200 gpm through the system with 4-inch piping. But a 25-hp unit is required if 2½-inch discharge piping is specified.

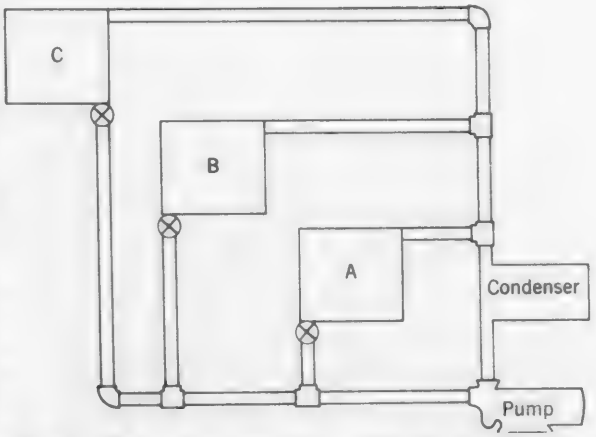


Fig. 7. Piping arrangement permits six combinations: A only in use, B only, C only, combinations A-B, B-C, and A-C.

Obviously, the latter is not a wise selection. Not only would the initial pump cost much more, but operating expenses would be substantially increased throughout the entire life of the unit.

How was the tentative decision made to use 4-inch discharge piping? Why not 3, 3½ or even 5? There is a rule of thumb that quickly determines this. A good flow for water for pipe sizes of 5 inches and less is obtained at velocities between 6 and 8 ft per sec. The system will have less noise and less head loss. From Fig. 4 the proper size piping can be selected by reading up from the desired flow rate to a point between 6 and 8 ft per sec velocity and then to the right until a pipe line curve is intersected. In this way we obtain 4 inch pipe. This size will yield a good flow for the least investment in piping.

System Curve

Pump selection is not yet complete. Although, the 7½-hp unit will supply the system under ideal conditions, we still do not know what will happen under less than ideal conditions. What happens when someone shuts off the discharge valve part way; or the compressor breaks down and 10 psi is removed from the tank; or the lines become partially clogged?

All of these questions can be answered by plotting the system curve and superimposing the head-capacity curve and the brake horsepower curve of the proposed pump, as in Fig. 2.

The 4 inch curve is a relatively flat system curve. Flat system curves lose capacity much more rapidly as the pump impeller wears than steep curves. There is also substantially greater change in capacity as changes occur in the static head. For example, if the air pressure on the tank is lost, the static head will drop and the new operating point could be beyond 7½ hp. This will seriously overload the driver and possibly cause it to burn out.

It is not meant that the system should be redesigned with smaller piping merely to obtain a steeper system-head curve. Rather, be certain that a drop off in capacity is not critical and that the driver is large enough to handle the excess load created by reduced static head.

Where to Put the Pump

This isn't much of a problem when dealing with an open-end system, but it can be quite a problem with closed systems, as in air conditioning.

An open-end system is limited by how much any pump can lift. You are usually committed to placing the pump at or near the lowest point in the system. If the system is completely closed, the vertical height to the suction nozzle does not represent lift since the discharge line return will automatically create suction pressure. The only head in the system is represented by system losses; the discharge static head is balanced by the return static head. In either type system, open end or closed, one good rule to follow (when there is leeway in placement of the pumping unit) is *Locate the pump where more than adequate suction pressures are available.*

On the other hand, it should be remembered that standard casings can withstand only limited pressures. It is unwise to place the pump at a point in the system where overly high suction pressures require a special pump casing.

Special Systems

The three most commonly encountered special systems are parallel pump operation, series operation, and the variable system. Each of these call for careful examination to avoid serious trouble.

Parallel pump operation is the most common. The problem of whether to have one 700 gpm or two 350 gpm units is one of economics and engineering. If the demand calls for 350 gpm 75 to 80% of the time, with 700 gpm peaks, then it would be best to use more than one unit. But space limitations, foundation costs, and so on must be considered.

Regardless of what basis you use for making this decision, in parallel pumping *beware of pumps with drooping curves!* A drooping curve is one on which the maximum head occurs at some point other than shutoff (no flow). Don't ever use pumps with drooping curves for parallel pumping. This may be difficult, as frequently, another pump is added to the system at some later date. The original pump may have a drooping curve.

It is difficult to conceive any condition or system in which a drooping curve is advantageous. A drooping curve, however, often results in design when an extremely flat characteristic is desired. When the droop is small and when it does not appear the droop will be harmful, the drooping characteristic can be acceptable.

The pump curve should rise continually from full capacity to zero flow. Pumps with drooping curves can get into the problem illustrated in Fig. 6 where the one pump curve intersects a given head at two different points. The pump will hunt back and forth between the two. This can actually shake the system apart.

One of the most common uses for series operation occurs when limited suction pressures are available. By using a slow speed first stage pump, the suction conditions can be met. Here again, avoid pumps with drooping curves. Specify pumps with continually rising curves to generate the head within a narrow capacity range.

Variable systems are not uncommon. A typical example is a centralized air conditioning system with individual shutoff controls for major segments of the system. This can lead to a whole series of operating conditions and system curves as shown in Fig. 7.

The important consideration in the variable system is that any individual variation or combination of variations that can exist must be accounted for in the original solution to the pumping problem. Each possible variation should be considered as a separate system.

This concludes Mr. Pollak's four part series on selection of centrifugal pumps.

INLETS AND OUTLETS—III

Correcting Fan Inlet Spin

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AS DEFINED IN PREVIOUS ARTICLES, the AMCA Fan Test Code specifies that the flow of air entering a fan inlet should be in straight lines—which, in these articles, we are calling "standard" inlet flow. Any other type of entrance flow—"non-standard"—will reduce the performance of a fan and consequently of the system to which the fan is connected.

A somewhat common type of inlet connection is one that imparts a spinning motion to the entering air. There are many types of duct configurations which can create such a condition. The flow in some instances will be in the same direction as the rotation of the fan wheel and in other instances the air rotation will be counter to that of the wheel.

In a fan wheel, the pressure rise is proportional, among other things, to the change in angular momentum imparted to the air. If C_1 (Fig. 1) represents the tangential air velocity component at the wheel inlet radius R_1, and C_2 represents the tangential velocity at the wheel tip radius R_2, the change in angular momentum is proportional to the expression

$$(C_2R_2 - C_1R_1)$$

If straight air flow exists at the fan inlet, as indicated in Fig. 2, the inlet tangential velocity (C_1) is zero and the pressure rise through the wheel is therefore represented by C_2R_2. If, however, the inlet connection imparts a spin to the air in the direction of the wheel rotation, Fig. 3, the inlet tangential velocity (C_1) is greater than zero and the total angular momentum or pressure rise through the wheel is reduced. The lower the pressure rise through the wheel, the lower is the volume flow. If the rotation of the inlet air is in the same direction as that of the wheel, the power required to drive the fan is lower than the normal curve and if against the wheel rotation, the power is higher.

There are many duct arrangements that can easily create an entrance spin. Two typical duct configurations are illustrated in Fig. 4. Since air has mass, it will flow to the outside of round or rectangular elbows and, as it tries to straighten itself out, it comes under the influence of the fan inlet (see Fig. 4*a*) which accentuates the already misaligned flow in the elbow and a spinning motion is established. In the instance of the unbalanced plenum chamber, Fig. 4*b*, the larger inlet with a greater volume of air overrides the smaller inlet and spin may be created.

If the spin is in the direction of wheel rotation, the difference between the velocity entering the blades

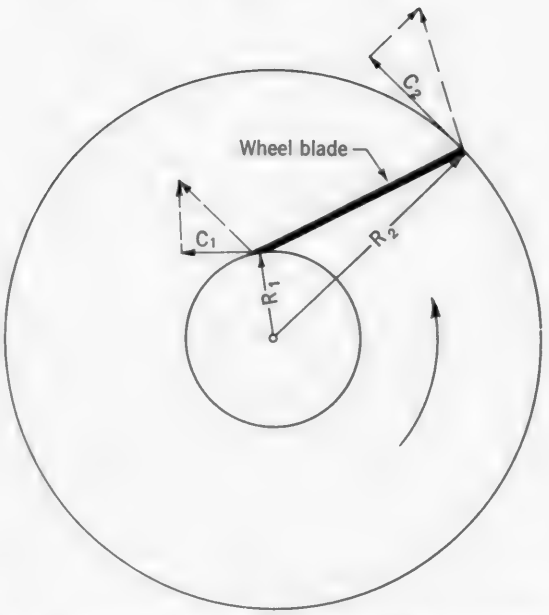


Fig. 1. Diagram illustrating the change in angular momentum of the air from the inlet to the periphery of the fan wheel.

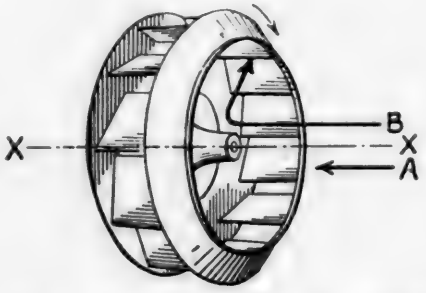


Fig. 2. Straight air flow at the fan inlet. Tangential velocity is zero.

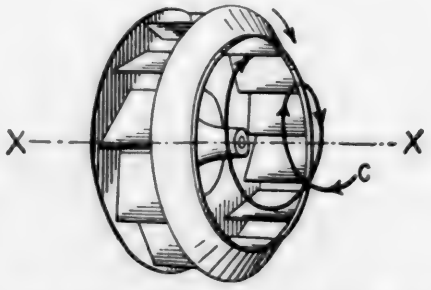


Fig. 3. Inlet connection imparts a spin to the air in the direction of wheel rotation. Total pressure rise through the fan is reduced.

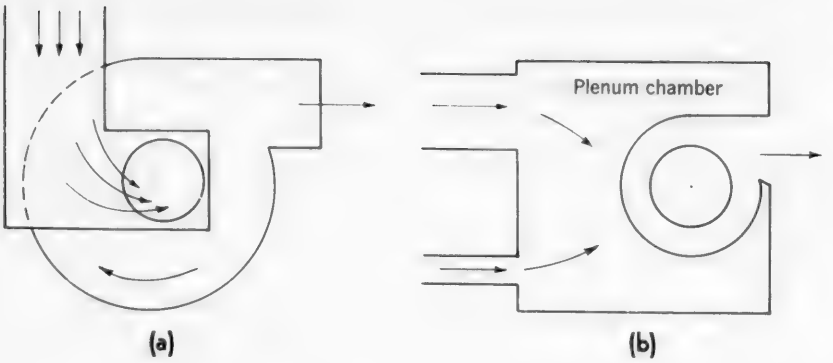


Fig. 4. (a) Inertia of air tends to crowd it to bottom of inlet, setting up spin. (b) With two unequally sized inlets to plenum chamber, imbalance is set up, causing spin at fan inlet.

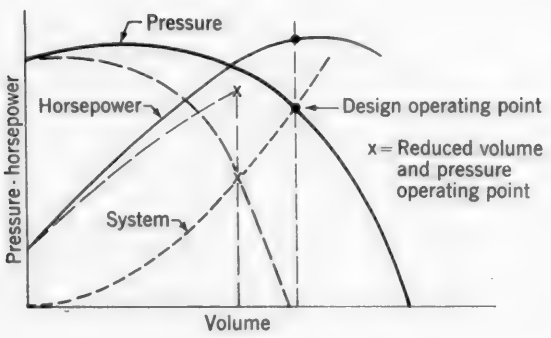
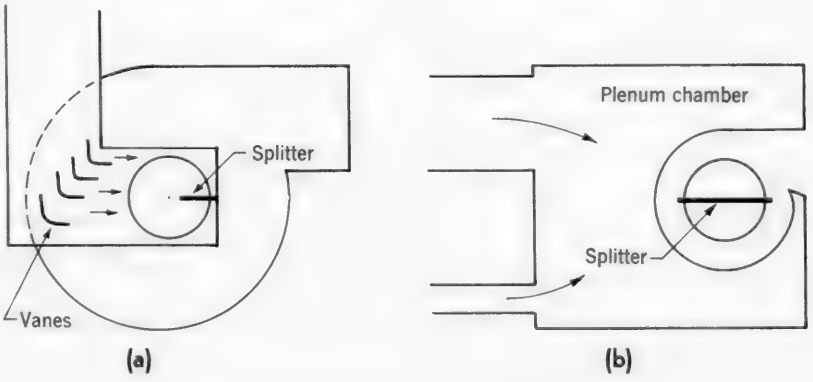


Fig. 5. Performance is sharply decreased due to spin in the same direction as the motion of the fan wheel. Both pressure and volume are affected.

Fig. 6. (a) Vanes and splitter prevent spin in inlet box while (b) a splitter overcomes the imbalance that is due to unequal inlets.

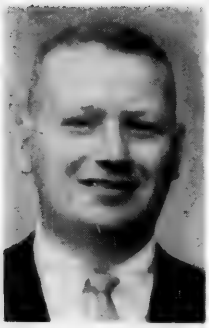


and leaving them is lower and less work can be done on the air—the pressure rise through the wheel is lower, the volume and horsepower are reduced, Fig. 5. For spin in the opposite direction, the pressure rise and volume are lowered, but since the wheel has to straighten out the air flow before work can be done, more energy is required and the horsepower is actually above the curve.

Elimination of the spin can be accomplished by moving the elbow away from the immediate fan connection to allow the air to straighten itself out so that it will flow in reasonably straight lines as it enters the fan. The elbow should be located about five diameters from the inlet fan. An alternate solution is to vane the duct elbows properly (Fig. 6*a*) in order to insure straight flow. It is suggested that a splitter at the end of the duct connection be used to insure the absence of spin. For the unbalanced plenum chamber, an inlet splitter (Fig. 6*b*) will eliminate the possibility of entrance spin.

Where inlet connection problems as discussed above are inevitable due to space limitations, it may be well to investigate the newly introduced in-line air flow centrifugal fan. With this fan, the air enters and leaves the fan in a straight line. This characteristic offers installation possibilities which may eliminate the need for troublesome inlet connections.

Fan manufacturers have taken advantage of the volume and horsepower reduction characteristic of entrance spin and furnish inlet vane air spin control as an accessory to obtain reduced volume flow for variable system requirements. Vane control is substantially more efficient than outlet dampers and for part load operation over extended periods of time, the horsepower savings can be easily evaluated. The spin characteristic establishes a new fan pressure—volume curve, which is considerably steeper than the curve without spin (*i.e.*, with the vanes fully open), Fig. 5. The fan performance is, therefore, more stable at reduced flow and for momentary system resistance variations the corresponding volume changes will be lower.



Quick-Sizing Charts ➡

for plumbing water supply piping

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THE AMOUNT OF WATER required in a building generally is determined by two classifications, i.e., by constant demand and by variable demand. (In this article we are concerned with pipe sizing determined by peak flow rates and not necessarily over all water consumption).

Under the classification of constant demand are such amounts as are consumed by the following:

Process work, Cooling tower make-up, Irrigation or lawn sprinklers, Condensate cooling system, Lane or gang showers in schools or industrial plants, and Steam plant water make-up.

These items and others can generally be designed to operate at specific gallon-per-minute flow rates.

Under the classification of variable demand is the amount of water consumed by the plumbing fixtures to be installed in the building. Of the many ways devised to estimate this amount, the most prevalent method used today is the "demand fixture unit" method. This method involves assigning various weights or fixture units to the types of plumbing fixtures,* totalling these units, then applying them to a graph to obtain an estimated gallon-per-minute flow rate. Combining the constant demand and the variable demand will give a total estimated demand flow rate for a building, or part of a building.

All water flowing through the piping system causes friction head loss, generally expressed in feet head or pounds pressure loss per 100 feet of pipe. This loss will vary with each pipe size for a specified flow rate. Also, as the flow rate through a given pipe size varies, so will the friction loss.

A specific pounds pressure is allowed for friction losses. The object then is to pick the proper pipe size so that the total loss in the system does not exceed this allowance.

To simplify pipe size selection, most engineers average the losses. That is, they take the longest run of pipe from the point of supply to the furthest highest fixture, add to this run the equivalent number of pipe feet for fittings and valves, divide this amount by pounds pressure (or feet head) available and then multiply by 100 to arrive at the allowable loss per 100 feet of pipe. Then, each pipe size is selected to have a friction loss equal to or less than this allowable amount.

A great deal of time is wasted today by tediously counting fixture units, then checking a graph to determine the relative gallons per minute, then picking a pipe size from another graph or table that will deliver this quantity of water at the specified pressure drop. This procedure in many cases is repeated over and over again as each branch is added to the main. The accompanying charts are designed to eliminate this time-consuming cross reference.

Once desired pressure drop is determined, the engineer, knowing the piping material, copies the appropriate head loss line on to his calculation sheet. With each pipe size is given a recommended maximum fixture unit count and equivalent gallon-per-minute flow rate. As total fixture unit increases, pipe sizes are increased to match the count allowed.

Large flow rates have been limited to a maximum velocity of 10 fps, and it is not recommended to exceed this. For those who do not wish to exceed a flow rate of 5-6 fps, reference should be made to the velocity sizing line in each chart.

***Fixture Units**

Fixture	DFU[1]	Fixture	DFU
Bain Marie	2	Lavatory, private	1
Bathroom Group:		Lavatory, public	2
flush valve	8	Potato peeler	3
flush tank	6	Sink	2
Bath, private	2	—clinic	3
—public	4	—flush rim	10
—sitz	2	—service	3
—arm or leg	3	—plaster/pack	2
Bed pan washer	10	Sink—tray comb	3
Dental unit		Shower, private	2
(EENT cuspidor)	1	—public	4
Drinking fountain	.5	—emergency	6
Hose connection—¾"	4	Sterilizer	1
Kitchen appliances:		Urinal, flush valve	5
kettles	2	—flush tank	3
scullery, pot wash	4	—pedestal	10
sink, veg. and meat prep.	4	Wash fountain, per faucet use	2
prewash sink	2	Water closets	
salad sink	2	private FV	6
sink, pvt. home	2	private fl. tank	3
Laundry tray		public FV	10
(each compartment)	2	public fl. tank	5

[1] DFU as listed is total demand, including where applicable both hot and cold water. For main cold or hot water piping, allow 75% of total for calculating each separately. At point of connection of cold water supply to hot water heating equipment, add one-third of the total hot water fixture unit count to the cold water main fixture unit count; e.g., if total hot water DFU is 1500 and cold water main DFU is 2500, then DFU from point of connection back to meter, assuming hot water supply connected after meter discharge, is 3,000 DFU.
For DFU curves, see National Plumbing Code.

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QUICK-SIZING CHART FOR WATER SUPPLY — TYPE K COPPER TUBE

GPM = U.S. Gallons Per Minute at ± 0.02 ft per 100 ft head loss. DFU (1) = Demand Fixture Units without flush valves. DFU (2) = Demand Fixture Units with flush valves.

Pressure Drop per 100 Ft of Pipe, Ft Hd	Units of Allowable Maximum Load	Nominal Pipe Size and Actual Inside Diameter, Inches									
		¾ 0.745	1 0.995	1¼ 1.245	1½ 1.481	2 1.959	2½ 2.435	3 2.907	4 3.857	5 4.805	6 5.741
0.4	GPM	0.5	2	3.5	4	11	18	30	45	120	210
	DFU (1)	—	—	4.5	5	14	29	54	104	480	1000
	DFU (2)	—	—	—	—	—	—	13	37	360	1000
0.6	GPM	1	2	4	6	13	23	39	60	145	235
	DFU (1)	—	—	5	7	18	38	80	175	620	1200
	DFU (2)	—	—	—	—	—	—	27	75	525	1200
0.8	GPM	1	2.5	4.5	7	14	28	43	90	167	268
	DFU (1)	—	—	5.5	9	20	49	95	325	740	1475
	DFU (2)	—	—	—	—	—	11	34	220	675	1475
1.0	GPM	1	3	5	8	18	31	50	106	188	305
	DFU (1)	—	4	6	10	29	55	125	410	860	1800
	DFU (2)	—	—	—	—	—	14	49	275	835	1600
1.2	GPM	1.5	3	6	9	20	35	55	117	208	334
	DFU (1)	—	4	7	12	31	67	150	460	1000	2050
	DFU (2)	—	—	—	—	—	20	60	330	1000	2050
1.4	GPM	1.5	3.5	6.5	10	21	37	60	127	226	361
	DFU (1)	—	4.5	8	13	32	72	175	525	1140	2275
	DFU (2)	—	—	—	—	—	23	75	425	1140	2275
1.6	GPM	1.5	3.5	7	11	22	40	64	136	243	389
	DFU (1)	—	4.5	9	14	35	84	195	575	1275	2550
	DFU (2)	—	—	—	—	—	28	90	475	1275	2550
1.8	GPM	2	4	7	11.5	24	43	69	145	258	414
	DFU (1)	—	5	9	14.5	40	95	220	620	1400	2800
	DFU (2)	—	—	—	—	—	34	112	525	1400	2800
2.0	GPM	2	4	8	12	26	46	73	155	274	438
	DFU (1)	—	5	10	15	44	110	240	675	1540	3000
	DFU (2)	—	—	—	—	—	40	120	600	1540	3000
2.3 (1 psig)	GPM	2	4.5	8.5	13	28	49	79	166	295	470
	DFU (1)	—	5.5	11	18	49	120	260	730	1700	3300
	DFU (2)	—	—	—	—	11	45	150	675	1700	3300
2.6	GPM	2	5	9	14	30	52	84	178	315	505
	DFU (1)	—	6	12	20	54	135	290	800	1875	3750
	DFU (2)	—	—	—	—	13	52	170	750	1875	3750
2.9	GPM	2.5	5	9.5	15	31	56	89	188	334	535
	DFU (1)	—	6	12.5	21	55	155	300	860	2040	4150
	DFU (2)	—	—	—	—	14	64	196	835	2040	4150
3.2	GPM	2.5	5.5	10	16	33	59	95	199	353	565
	DFU (1)	—	6.5	13	23	61	170	350	930	1360	4575
	DFU (2)	—	—	—	—	16	71	220	920	1360	4575

Table by J. Getlan, Jos. R. Loring Associates. GPM data from Cameron Hydraulic Data published by Ingersoll-Rand Co.

QUICK-SIZING CHART FOR WATER SUPPLY — TYPE K COPPER TUBE

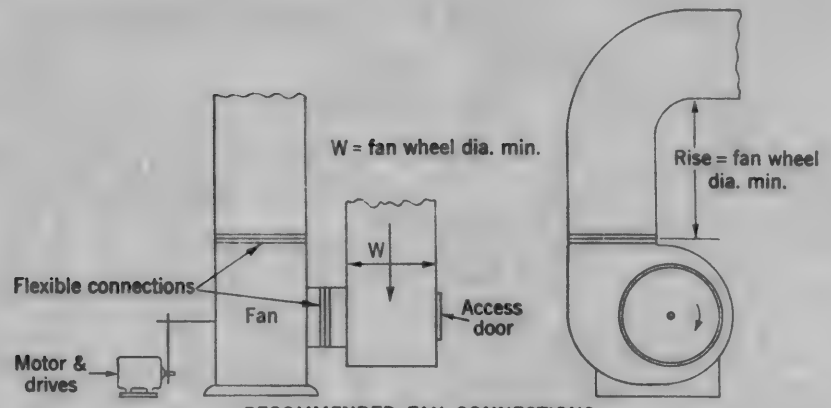
GPM = U.S. Gallons Per Minute at ± 0.02 ft per 100 ft head loss. DFU (1) = Demand Fixture Units without flush valves. DFU (2) = Demand Fixture Units with flush valves.

Pressure Drop per 100 Ft of Pipe, Ft Hd	Units of Allowable Maximum Load	Nominal Pipe Size and Actual Inside Diameter, Inches									
		¾ 0.745	1 0.995	1¼ 1.245	1½ 1.481	2 1.959	2½ 2.435	3 2.907	4 3.857	5 4.805	6 5.741
3.6	GPM	2.5	6	10.5	17	35	64	100	211	375	600
	DFU (1)	—	7	13.5	25	67	195	380	1020	1550	5100
	DFU (2)	—	—	—	—	20	89	245	1020	1550	5100
4.0	GPM	3	6	11	18	37	67	105	225	398	635
	DFU (1)	4	7	14	29	72	210	400	1125	2650	5000
	DFU (2)	—	—	—	—	23	97	275	1125	2650	5800
4.6 (2 psig)	GPM	3	6.5	12	19	40	72	115	242	430	680
	DFU (1)	4	8	15	30	84	235	450	1260	2950	—
	DFU (2)	—	—	—	—	28	115	330	1260	2950	—
5.0	GPM	3	7	13	20	42	75	120	257	449	712
	DFU (1)	4	9	18	31	90	250	480	1380	3090	—
	DFU (2)	—	—	—	—	32	130	360	1380	3090	—
5.5	GPM	3.5	7.5	13	21	45	79	126	266	475	755
	DFU (1)	4.5	9.5	18	32	104	260	500	1450	3375	—
	DFU (2)	—	—	—	—	37	150	400	1450	3375	—
6.0	GPM	3.5	7.5	14	22	47	83	132	280	498	790
	DFU (1)	4.5	9.5	20	35	112	290	540	1575	3675	—
	DFU (2)	—	—	—	—	42	165	440	1575	3675	—
6.5	GPM	3.5	8	15	23	49	87	138	291	520	790
	DFU (1)	4.5	10	21	38	120	310	580	1670	3950	—
	DFU (2)	—	—	—	—	45	185	480	1670	3950	—
6.9 (3 psig)	GPM	4	8.5	15	24	50	89	142	300	533	790
	DFU (1)	5	11	21	40	125	320	600	1750	4100	—
	DFU (2)	—	—	—	—	49	195	510	1750	4100	—
7.5	GPM	4	8.5	16	25	53	93	149	320	565	790
	DFU (1)	5	11	23	41	140	340	630	1910	4575	—
	DFU (2)	—	—	—	—	55	210	550	1910	4575	—
8.2	GPM	4	9	16	26	55	98	156	335	565	790
	DFU (1)	5	12	23	44	150	360	680	2050	4575	—
	DFU (2)	—	—	—	—	60	235	600	2050	4575	—
8.8	GPM	4.5	9.5	17	27	57	102	163	343	565	790
	DFU (1)	5.5	12.5	25	47	160	400	720	2125	4575	—
	DFU (2)	—	—	—	10	65	260	650	2125	4575	—
9.2	GPM	4.5	9.5	18	28	59	104	167	350	565	790
	DFU (1)	5.5	12.5	29	49	170	400	725	2180	4575	—
	DFU (2)	—	—	—	11	71	275	680	2180	4575	—
Velocity Sizing, 5 fps	GPM	7	12	18	25	50	87	126	225	353	505
	DFU (1)	9	15	29	41	125	310	500	1125	1360	3750
	DFU (2)	—	—	—	—	49	185	400	1125	1360	3750

Table by J. Getlan, Jos. R. Loring Associates. GPM data from Cameron Hydraulic Data published by Ingersoll-Rand Co.

FAN-TO-DUCT CONNECTIONS

Flexible Connections



RECOMMENDED FAN CONNECTIONS

Flexible connections should be installed between a fan unit and metal ducts or casings to prevent transfer of fan or motor vibration.

Flexible materials must be in folds (not drawn tight). If canvas is used, it should not be painted.

The following is quoted from Pamphlet No. 90-A of the National Fire Protection Association.

Par. 113 (b) Vibration connectors in duct systems, other than as covered by paragraph 113 (c), shall be made of woven asbestos or approved flame proofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved non-combustible material.
Vibration connectors of fabric shall not exceed 10 inches in length.

Top, left — An elevation of fan unit showing a flexible connection at fan discharge, also collar and flexible connection to fan inlet. To avoid turbulence and air pulsation the width of the duct leading to the fan inlet should be equal to or wider than the fan wheel diameter.

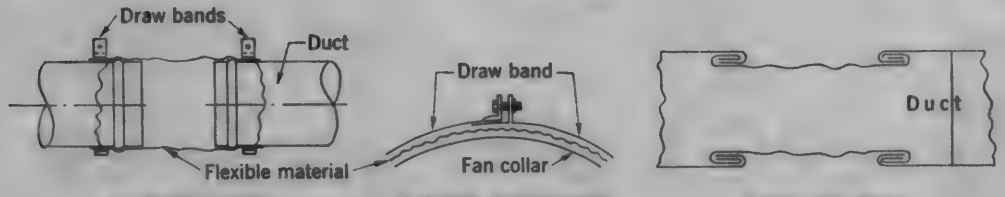
Top, right — A side view of fan showing position and rotation of the fan in relation to the duct elbow above. The rise of duct should be equal to or greater than the fan wheel diameter.

Detail 1 — Flexible material installed between sections of round duct using draw bands for fastening same to duct.
The same detail applies at fan intake collar.

Detail 2 — Indicates method of clamping the draw band on round ducts, drawing same tight with bolt.

Detail 3—A flexible connector on a rectangular duct, indicating method of locking the fabric to the metal duct.

Note: Flexible connections with metal collars locked to same are available from several manufacturers.



(1) ROUND DUCT (2) DRAW BAND DETAIL (3) SQUARE DUCT

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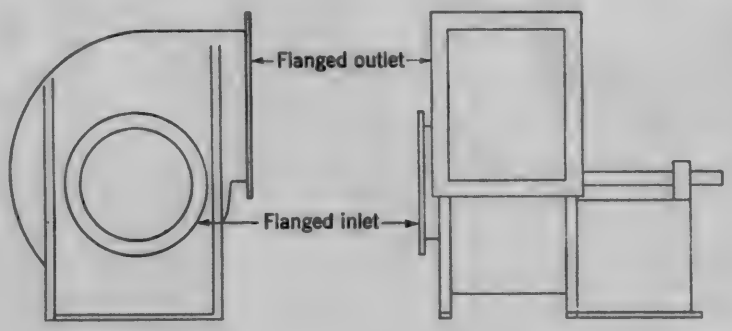
FAN-TO-DUCT CONNECTIONS

Flanged Connections



FLANGED FAN CONNECTIONS are used when:

1. The tightest possible connections are desired, without welding.
2. Fan and duct are to be easily separable, for maintenance, inspection or replacement.
3. No attempt is made to apply vibration isolation bases to the fan. (When vibration bases are used the fan should have flexible connections.)

FLANGED INLETS AND OUTLETS are normally furnished by the fan manufacturer without holes. The installer uses his fabricated companion flange as a template to drill matching holes in the fan.

FLANGED INLETS AND OUTLETS can be predrilled by the fan manufacturer to either the manufacturer's standard or the installer's specifications. If the installer specifies the hole size and spacing he should send the fan manufacturer an accurate sketch. A better method is to ask for the manufacturer's standard hole size and spacing, and ask the manufacturer to send a standard detail drawing.

COMPANION FLANGES are available from the fan manufacturer suitable for attaching to ducts, and they are made to match the holes in the fan flanges.

THE TYPE OF GASKETING depends upon the service, and upon the tightness required.

NO GASKET — More fans are installed without any gasket or sealant than with. Where there are no toxic or corrosive elements in the air stream, small leaks are not objectionable, duct sections need to be easily removable, static pressures at the flanges do not exceed 4" to 6" SP, and both halves of each flange are heavy enough to prevent gaps, it is usually satisfactory to omit gasketing.

CAULKING — When an inexpensive, but not necessarily perfect gasket is called for, ordinary building grade gun type putty (caulking compound) can be applied generously to the flat flange surfaces before they are drawn together. This will provide a fairly good seal up thru about 20" SP. (Special grades of caulking may be used for higher pressures.)

SOLID GASKETING — When toxic or corrosive fumes are being handled, or absolutely no leakage can be tolerated solid gaskets should be used. They should be the full width of the flanges, with drilled or punched (not slit) holes for bolts. The uncompressed material should be at least 1/4" thick and soft enough to mold to the flange faces. Recommended materials are:

- — For fans handling non-corrosive air or gas, up to 300°F — Buna rubber or Neoprene between 30 and 60 durometer.
- — For fans handling non-corrosive air or gas above 300°F — woven asbestos or soft asbestos board.
- — For fans handling corrosive fumes or gas — give full chemical and temperature analysis of gas to a supplier of packing and gasket materials, and ask them to select the proper material with 1/4" minimum thickness.

Prepared for ACHV by C. J. Trickler, Chief Engineer, The New York Blower Co., Chicago, Ill.

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

December, 1961

Condensers in Parallel

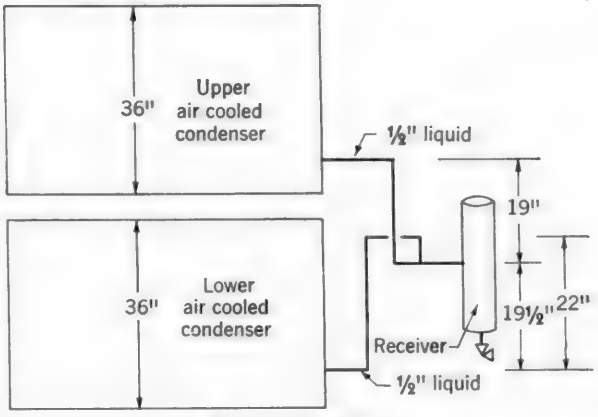
"My problem concerns the refrigerant liquid piping from . . . condensers stacked vertically and connected in parallel on a single . . . circuit."

The Editor
AIR CONDITIONING, HEATING AND VENTILATING
93 Worth Street
New York 13, N. Y.

. . . Would you kindly pass my question on to Mr. Ramsey for his comments . . .

My problem concerns the refrigerant liquid piping from multiple air cooled condensers when stacked vertically and connected in parallel on a single refrigerant circuit. We have an installation of this sort with two condensers which are on approximately the same elevation as the compressor and evaporator and in which the liquid connection from each condenser is located at its lowest tube but the lower connection rises approximately 22 inches into the receiver inlet and the upper condenser liquid connection drops approximately 19 inches into the same receiver inlet connection. The condenser coil height, or finned width, is approximately 36 inches, and the two coils are located one directly on top of the other. (See Mr. Martin's sketch.—Ed.)

I contend that the liquid refrigerant will collect in the 22-inch trapped height of the lower condenser and thus reduce the condensing surface by this amount while it is also likely to allow non-condensed refrigerant vapor to return to the evaporator expansion valve unless the system is so over-charged that the trapped refrigerant does not sufficiently reduce the working charge.



Reader's Problem

I feel certain this is the reason the installation does not appear to be handling the load as it should but have been having a hard time trying to convince the contractor who installed it as he has the installation instructions from one of the leading manufacturers which illustrates this type of arrangement. Can you see how it could possibly work in this manner at full efficiency or why it should be expected to operate much differently than I have contended?

M. B. Martin, Jr.
5712 Oakview Drive
Waco, Texas

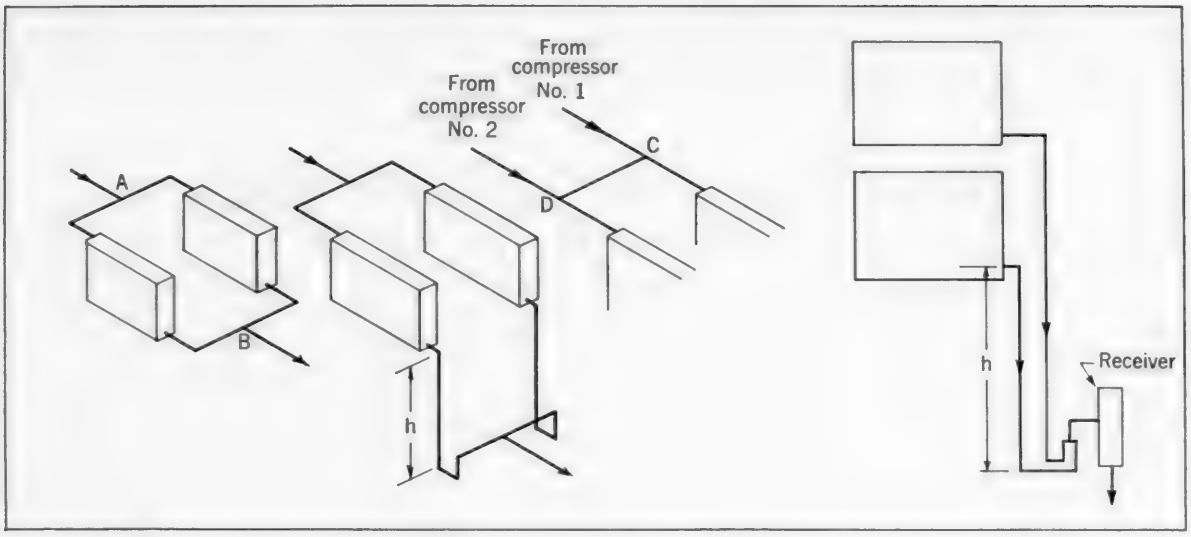
Dear Mr. Martin:

The operation of condenser circuits in parallel seems to be one of the least understood subjects and one which therefore often results in poor system performance.

Refrigerant condensers are exactly the same as radiators or heating coils in steam heating systems. These are merely steam condensers. Most heating engineers or contractors know if they connect two or more steam heating coils in parallel they are not likely to have satisfactory operation unless the returns are separately trapped or have adequate loop seals. (Of course, in a steam condenser there is also an air venting requirement which must be taken care of and which is not normally present in the refrigerating condenser because the non-condensibles have usually been removed.)

It is impossible to predict just what will happen with the two parallel condensers shown in your sketch without having the discharge piping connections. Even then, it is very difficult or impossible because of other factors. For example, sketch No. 1 shows two condensers with equal circuits. If the pressure drops through either path from *A* to *B* were exactly equal, with equal liquid levels, the operation would be satisfactory. However, such a condition would require that every detail be identical and the air or other fluid flow over both condensers be the same.

If one condenser removes heat faster than the other, the flow through that path and its pressure



Ramsey's Solution

drop will be greater. The full pressure loss through each path must be equal and the liquid level of the condenser removing the most heat must be enough higher than that in the other to balance the extra flow loss. If the flow resistance through one path is 0.5 psi more than the other, the liquid refrigerant (12 or 22) must have about one foot liquid column so that it can discharge. If this level rise must flood part of the condenser, that is what will be the result. Filling part of the condenser would reduce its effectiveness and the flow resistance through its circuit so that the actual rise would be less than one foot for that case.

Sketch No. 2 shows connections which provide for this difference in pressure drop. If h is at least as great as to correspond to the largest difference between the two circuits, the necessary column will not fill either condenser but only the small volume of the vertical pipe. (The liquid line may rise again, either as a single line or as separate lines before joining.)

Sketch No. 3 shows a method often used when connecting two compressors and two condensers in a common circuit. Because an "equalizing" line is used, it doesn't mean that the pressure at C and D are equal. If, without the line, the pressure would be unequal, there will be a flow in the line and a flow results in a pressure drop. The "equalizing" line never equalizes pressures. It only makes them more nearly equal. The importance of small pressure differences is clear when one realizes that one psi is equal to about a two-foot column of 12 or 22.

Sketch No. 4 shows how I would make the condenser drain connections in the case you described. If h is larger than the column corresponding to the greatest difference in pressure between the two condenser outlets, operation will be satisfactory. The receiver can be raised to the level you showed if desired, so long as the drains first drop as shown.

If there is not space for these loops or traps, a high-pressure float may be put in each line. These may be any common high-pressure steam trap of the bucket or ball float type. If these were the only expansion valves (which is often not practical), the pressure drop through them, with full flow, might be fairly large——like the usual amount available for expansion valves. Since that is probably not possible in this case (certainly not with a receiver as shown) the pressure loss through such a trap would probably be limited to about 5 psi to leave pressure drop for the present expansion valve or valves and to avoid eliminating all the subcooling of the liquid at the condenser outlet.

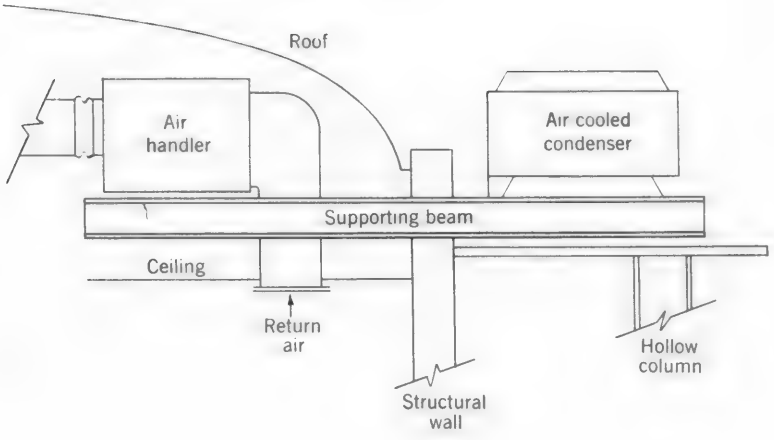
With air cooled condensers, the difference in pressure losses through the condenser circuits can be appreciable because the loss at full load is usually two to seven psi. With shell and tube condensers (with refrigerant in the shell) the loss is very small so that the greatest difference between the losses is likely to be small. However, the difference in loss through the piping circuits from the points where they separate to where they join, may be appreciable. I just saw one where it was such that three foot legs were not enough. Since the loops or traps could not be extended without going into the ground and the cost of any piping changes necessary would be greater, high-side floats were installed to correct the problem.

I wonder if you have thought of leaving out the receiver. That wouldn't effect the condenser liquid level problem but it reduces the refrigerant required for the system and improves the operation. All of our condensers, and I think most others, have sufficient volume to serve as condenser receivers (allowing for pumpdown) in practically all cases. Check yours before removing the receiver; you will probably find it superfluous. Of course with head pressure controls which flood the condenser during cold periods, a receiver is necessary but it may sometimes be connected differently as I plan to discuss in an article next year.

Melvin A. Ramsey

Use Skyhooks to Make Your Jobs Look Better

LOUIS H. V. SMITH
Engineer
Sarasota, Fla.



SKYHOOKS ARE OFTEN WISHED FOR by engineers and installation crews when there is no suitable place for equipment. Just such a job was the City Ballroom in Sarasota, Florida. It is an open room in an existing building and is used for dances, meetings and parties. It required sixty tons of air conditioning to make it more useable during the summer months.

Naturally, there was no good place for equipment except on the floor of the ballroom. This was obviously wrong from an aesthetic angle. Thus the answer was a field assembled system with the equipment tucked into whatever out-of-the-way corner that could be found.

A spot was found for the compressor on the ground floor, under a stair, near the electric service entrance. This solved one problem adequately. By using room that was useless for other purposes, the compressor found a home.

There was plenty of space above the ceiling for the air handling unit. This gave short duct runs to the overhead air diffusers. Putting return into a plenum adjacent to the unit further helped to simplify sheet metal work. Access to the space was easily accomplished by a trap door in the roof. The main drawback is obvious to any engineer who works with existing buildings. The roof was strong enough to support itself but not the additional weight of the air handling unit. The cost of reinforcing the long spans of the roof structure naturally was excessive.

Condensing equipment was the next problem. Cooling water from a well source is seldom satisfactory in this area due to poor water quality. An air cooled condenser was decided upon and a location was picked at the corner of the building just above the compressor room. With supporting steel resting on two structural walls and refrigerant lines run on the outside of the building, the technical problem was solved. Unfortunately, neither the piping nor the condenser did much to enhance the beauty of the building.

The eventual solution was a low silhouette condenser mounted on top of a fragile concrete sun shade that was supported by hollow decorative columns.

By locating the condenser on the sun shade and the air handling unit below the roof on the opposite side of a structural wall, it was possible to balance the weight of one against the other by means of a beam supporting the two and resting on the wall. Distance from the wall was adjusted (by calculation) so that the total weight of both pieces of equipment was supported by the wall. Thus, no load was put on the sun shade or on the roof structure. By running refrigerant lines inside the hollow columns supporting the sun shade, it was possible to eliminate one other aesthetically objectionable feature.

In this particular instance by using the weight of one piece of equipment to balance that of another, it was possible to complete the job without detracting more than necessary from the appearance of an existing building.

Apportioning Cooling Costs to Office Tenants

FREDERICK H. KOHLOSS
Frederick H. Kohloss & Associates, Consulting Engineers
Honolulu, Hawaii

In a small Honolulu office building project, an unusual method of billing tenants for cost of air conditioning evolved from owner-designer cooperation. Kenrock, Ltd., owned two 2-story office buildings with a large parking area, in a desirable commercial location, and decided to erect a third building, 2-story in front, with a single-story wing of offices over the existing parking area. Rentable office area is about 9,000 square feet. The roof is well insulated and long roof overhangs minimize solar heat gain through windows.

The first building, about 13 years old, has a single-zone direct-expansion central plant air-conditioning system, occupying first floor space and offering no individual tenant temperature control. The second building, about 10 years old, has packaged air conditioners in most offices, with a roof-mounted cooling tower, plus window air conditioners in one area. This has resulted in high operating and maintenance costs.

With these experiences, the owner set design criteria for the third building to provide individual tenant temperature control, flexibility for tenancy changes, and low operating and maintenance costs. Due to the year-around cooling season in Hawaii, cost of air conditioning operation is a major factor in rent charges. Psychologically, owners often find tenants prefer a low base rent, with lighting, air conditioning, janitor service, parking and other amenities surcharged. The owner wished to be able to charge tenants equitably for their share of air conditioning costs. Since some tenants used air conditioning in the evening and on weekends, and some did not, proportioning of cost by area rented would not be equitable.

The system designed under the author's direction includes a central water-chilling plant in a Transite-walled corrugated-metal roofed enclosure on the building roof. Two package chillers and a four-circuit air cooled condenser provide 27 tons when delivering 42 deg F water with 90 db and 75 wb outside. Four capacity steps are provided, based on return water temperature.

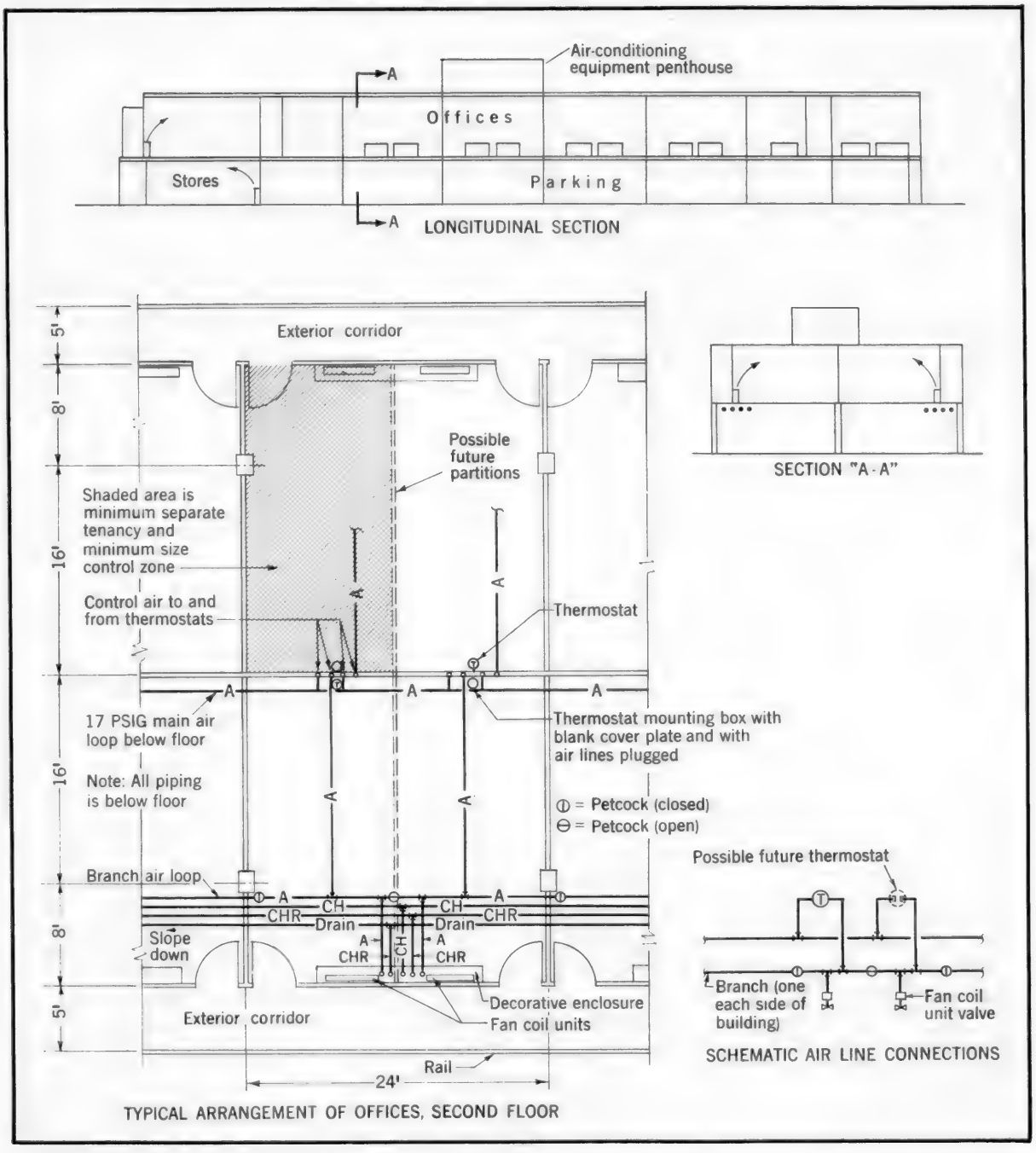
Chilled water is pumped to 36 fan-coil units in decorative sill-type enclosures. Units are sized to maintain zones at 75 db and 55% rd with 45 deg water, and have permanent split-capacitor fan motors three-speed fan switches, double deflection supply grilles and manual outside air dampers. Thanks to Honolulu's non-freeze weather, chilled water piping is run above the roof and exposed below the second floor, insulated with cellular glass.

A pneumatic temperature control system provides flexibility of control. Minimum area for a single tenancy is one-half column bay, and there is one fan coil unit for each such area. Room thermostats control water valves in each fan coil unit. Initially one thermostat was provided for each full column bay (possibly two tenants) but a thermostat mounting box is provided in each half-bay. Control air piping for thermostats and unit valves is arranged in a loop so that a given thermostat can control one or more valves for a given zone, and so that if control zoning changes, an additional or a different thermostat may control the same valve or valves. The assignment of a given thermostat to control one or more unit valves is by use of petcocks in the looped control air branch line for the valves.

An electricity meter is provided for each minimum tenancy (½ column bay), to which is connected the lighting and receptacle circuits and the motor or the fan coil unit. These tenant meters are grouped. An inexpensive time meter is provided in the circuit of the fan coil unit, and the time meters are mounted with the electricity meters. The electric utility company offers a lower rate when the building's accounts are kept in the owner's name and he is responsible for all tenants' bills. The utility reads all electricity meters and renders individual bills for each meter. The owner has an electricity meter for area lighting and one for the central water chilling plant, the latter on a special low power rate for refrigeration.

Tenants pay the owner for the electric consumption recorded by their individual meters. They also pay their prorated share of the billing on the electricity meter of the central water chilling plant. The owner reads each tenant's time meter monthly for his fan coil unit and multiplies hours of operation by area rented. This product is the basis for prorating water chilling operating costs to tenants. A simple form was prepared for the owner to record and compute tenants' costs, and the tenant receives a copy of this completed form with his bill, if requested.

The owner pays for air conditioning maintenance, which is fixed by contract and is complete "insurance" type maintenance. Each tenant pays for his air conditioning operating cost in proportion to his rented area and the hours of air conditioning operation per



month. The owner need not try to guess the amount of weekend or evening operation and allow for it in a fixed rental charge for air conditioning. The tenant using this space only during regular office hours does not have to share off-hour operating costs as he would if cost were apportioned by area rented. Changes in tenancy, or in area rented by tenants, are easily made by reconnecting wiring at the meters and by adding or removing thermostats, and opening or closing control air petcocks.

There is no allowance for severity of exposure or variation in thermostat setting for particular tenants, or for variation in water chilling plant efficiency at light loads. These factors have not created any problem in the first year's operation. Tenants find the lease arrangement satisfactory, and like the low noise level and flexibility of control.

The owner likes the low operating cost and low fixed contract maintenance cost on the water chilling system, and the fact that the system uses no rentable space.

Architects for the building were Lemmon, Freeth, Haines & Jones. Wynn M. Nakamura was the electrical engineer. Air conditioning and electrical contractors were Heide & Cook, Ltd. and George Morishige, respectively.

At left, the rear of the main church area and baptistry is served by two dual combination air handling units inside the attic area. The four remote compressor-condenser units located on the ground are seen with refrigerant lines running to the attic.

On Second Thought, Packaged Heat Pumps

USE of factory assembled heat pumps is said to have saved Palo Verdes Baptist School and Church, Tucson, Ariz., 12% on installation and 15% on operating costs over an original proposal for a central system for the church and small, window-mounted heat pumps for its school.

Total capacity serving three buildings is 36 tons, provided by ten units of 2, 3, 4, and 5 tons each. Pastor Earle E. Matteson is grateful for the assurance that, in case of equipment breakdown, there will be no interruption in church programs.

In the case of the school, window-mounted heat pumps were rejected as too noisy. To prevent transmission of mechanical noise to classrooms, each unit is isolated on a vibration mount, a 6-inch thick fiberglass pad resting on a low brick platform. (See headpiece right.) Atop the pad is a sheet metal cover on which the heat pump rests. Supply ducts are lined with fiberglass that serves as both thermal and acoustic insulation. The short return duct from each classroom has a simple sound trap designed by contractor Leonilo Larriva. It is a short section of double-width duct with a vertical sheet metal barrier across the air path. Returning air makes four 90-deg turns around it.

Even though average winter temperature is a mild 57 deg F, heat pumps had to be designed to hold 78 deg inside when outside rose to 105 or plunged to 25 deg.

Power in Tuscon at 1.65 cents per kwh, gives the heat pump an economic edge over conventional fuel. Add to this the absence of a separate heating system, boiler room, chimney and fuel supply, and a COP during average winter weather that gives 70.0 units of heat for the equivalent 31.7 units of electrical energy, and the advantage is obvious. Perfection Div., Hupp Corporation, manufacturers of the heat pumps, estimate that the cost of a mass-produced package heat pump system is 70% of the cost of a field-assembled system.

The choir loft is served by two 3-ton packages on either side of the loft and balcony area. Each unit has its own thermostat.

NEW LITERATURE

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Compact Air Handling Units

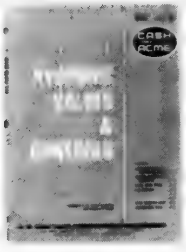
A 74-page manual, Form 6011C, issued by Dunham-Bush, Inc., West Hartford, Conn., contains complete data on compact air handling units for cooling, heating, and humidity control. Drawings, photos, charts and diagrams illustrate features of the units.

Circle **Item 1** on Inquiry Card

Small Unit Heaters

Carrier Corp., Syracuse, N. Y., has prepared a 20-page catalog, 46S 46U 46SE, containing specification data on small-capacity steam and hot water unit heaters. Data includes steam and hot water ratings, dimensions, and electrical and piping diagrams.

Circle **Item 2** on Inquiry Card



Hydronic Valves and Controls

Bulletin HYD-1, describing its line of valves for hydronic heating and cooling systems, is available from A. W. Cash Valve Mfg. Corp., Decatur, Ill. Covers motorized zone valves, reducing valves, pressure relief valves, and a series of dual controls.

Circle **Item 3** on Inquiry Card

Sewage Transfer and Treatment

Sewage lift stations and treatment plants are discussed in 16-page Bulletin 50 by Smith & Loveless, Div. Union Tank Car Co., Kansas City, Mo. Covers operating principles, and features of the various models. Includes color drawings, diagrams, and photos.

Circle **Item 4** on Inquiry Card

Comfort Conditioning

A 32-page brochure issued by Acme Industries, Inc., Jackson, Mich., uses case history reports to illustrate how organizations from coast to coast have solved their comfort-cooling-and-conditioning problems. Includes a review of company's growth and progress.

Circle **Item 5** on Inquiry Card

Temperature Regulators

How to select and apply temperature regulators for stable and accurate control of process, storage and instantaneous heaters, engine coolers and refrigeration exchangers is described in Bulletin 1014 published by Spence Engineering Co., Walden, N. Y.

Circle **Item 6** on Inquiry Card

Stainless Steel Sinks

The "Galaxy of Stars" line of stainless steel sinks for the home, school, church and institution is presented in a 40-page catalog available from Carrollton Mfg. Co., Carrollton, Ohio. Contains photos and dimensional line drawings of each model.

Circle **Item 7** on Inquiry Card

Furnace Explosions

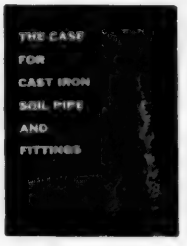
Furnace explosions are the subject of 16-page Bulletin E-101 issued by The Babcock & Wilcox Co., Boiler Div., Barberton, Ohio. Analyzes causes of 156 recent explosions, discusses theory of explosions during flameouts and recommends safe operating procedures.

Circle **Item 8** on Inquiry Card

Pressure and Vacuum Gages

Comprehensive data for specification of pressure, vacuum, and compound gages are contained in a 64-page catalog by Kunkle Valve Co., Inc., Fort Wayne, Ind. Drawings and illustrations supplement specification tables to enable selection of the proper gage.

Circle **Item 9** on Inquiry Card



Cast Iron Soil Pipe

A 20-page booklet, published by Cast Iron Soil Pipe Institute, Chicago, Ill., describes the many advantages in using cast iron pipe and fittings over non-metallic and soft-metal materials in underground applications and other highly corrosive environments.

Circle **Item 10** on Inquiry Card

Building Insulation

A 20-page catalog, "Foamglas Building Insulation," is available from Pittsburgh Corning Corp., Pittsburgh, Pa. Contains information on the use of Foamglas, a cellular glass insulation. Includes photos, application procedures, accessories, charts, graphs and more.

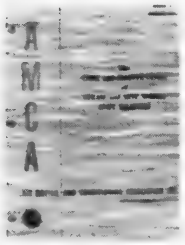
Circle **Item 11** on Inquiry Card

Industrial Processing Heaters

Todd Shipyards Corp., Products Div., Brooklyn, N. Y., announces an 8-page booklet describing its "Directaire" heater for use with existing or new heating systems. Features, specifications, typical uses, performanace data, dimensions, and selection are covered.

Circle **Item 12** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.



Unit Heater Maintenance

Bulletin 12, published by Air Moving and Conditioning Association, Detroit, Mich., covers the care and maintenance of steam and hot water unit heaters. Diagrams of the various systems are included as well as a discussion of system corrosion.

Circle **Item 13** on Inquiry Card

Seamless Welding Fittings

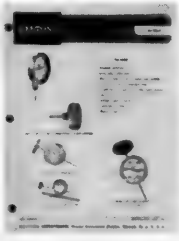
Bulletin TF-510, offered by The Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa., discusses 90 degree elbow (long tangent one end or both ends) seamless pipe fittings. Includes charts on all dimensions in nominal pipe sizes of 1½ to 12 inches.

Circle **Item 14** on Inquiry Card

Fly-Ash Collecting Equipment

Three major types of equipment for high efficiency fly-ash collection are reviewed in 4-page Bulletin RC-553, published by Research-Cottrell, Inc., Bound Brook, N. J. The application and performance characteristics of the various equipment are discussed.

Circle **Item 15** on Inquiry Card



Bimetal Thermometers

A 16-page catalog, No. 09-100, covering industrial, laboratory, navy, and pocket type bimetal thermometers, is announced by Weston Instruments Div., Daystrom, Inc., Newark, N. J. Features, photos, dimensions, and temperature range of each model is given.

Circle **Item 16** on Inquiry Card

Pressure Reducing Regulators

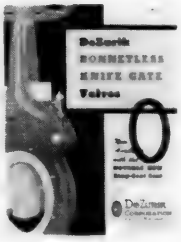
Strong, Conneaut, Ohio, announces 8-page Bulletin SM-71, giving complete engineering data on its line of pressure reducing regulators. Dimensioned drawings, charts, and photos illustrate the features of pilot operated, balance, and direct acting valves.

Circle **Item 17** on Inquiry Card

Infra-Red Heaters

Panelbloc Div., Bettcher Mfg. Corp., Cleveland, Ohio, announces 16-page Manual PE-2-61, on infra-red heater application. It describes body heat loss and methods of controlling it; full heating jobs and spot heating; and methods for calculating requirements.

Circle **Item 18** on Inquiry Card



Knife Gate Valves

Eight-page Bulletin 302, available from DeZurik Corp., Sartell, Minn., describes its rubber seated gate valves. Bulletin lists features of the valves as well as materials, dimensions, actuators, and outlines the broad areas where the valves are extensively used.

Circle **Item 19** on Inquiry Card

Dehumidifiers

Information on HoneyCombe dehumidifiers is presented in 4-page Bulletin 3003 issued by Cargocaire Engineering Corp., New York, N. Y. Includes a list of suggested applications, features of each model, and a diagram illustrating the HoneyCombe principle.

Circle **Item 20** on Inquiry Card

High Velocity Air Duct

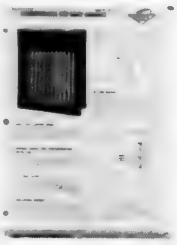
Acousti-k 27 duct and fittings are discussed in Bulletin A27-16 by Spiral Pipe Div., United Sheet Metal Co., Inc., Columbus, Ohio. Design data includes friction loss and acoustical noise reduction performance of straight duct, elbows and divided flow fittings.

Circle **Item 21** on Inquiry Card

Water Distillers

A portfolio, containing illustrated data sheets describing water distillation equipment, is available from Badger Mfg. Co., Cambridge, Mass. Includes flow charts, tables of sizes, and information on selection of the proper still for sea water conversion or processing applications.

Circle **Item 22** on Inquiry Card



Electric Heaters and Controls

Data Sheet LD-08, published by Wesix Electric Heater Co., San Francisco, Calif., covers the line of longitudinal fin duct heaters, commercial and industrial unit heaters, space heating equipment, and controls. Complete specifications are given.

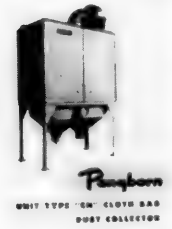
Circle **Item 23** on Inquiry Card

Surface Condenser

Bulletin 351, published by American Standard Industrial Division, discusses the S-1000 single bank, balanced flow surface condenser. Contains technical data, illustrations, specifications, and a list of applications including small turbine drives.

Circle **Item 24** on Inquiry Card

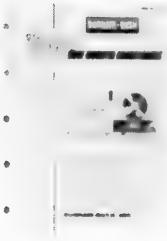
Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.



Unit Type Dust Collector

The Type CN unit dust collector is discussed in Bulletin 916, published by Pangborn Corp., Hagerstown, Md. Explains the cloth filter bag dust control equipment, how it is made, how it works, its range of use and application, and its special features and details.

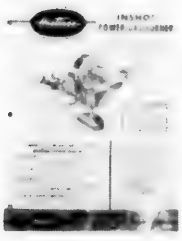
Circle **Item 25** on Inquiry Card



Roof Mounted Conditioners

Catalog 6023B, describing a new line of roof mounted conditioners is available from Dunham-Bush, Inc., West Hartford, Conn. Complete design and construction features are listed including components, accessories, wiring and flow diagrams, electrical data and more.

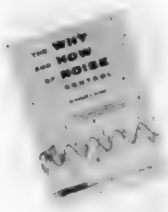
Circle **Item 26** on Inquiry Card



Power Gas Burners

Forms MX-1 and V-1, describing the Adjusto "V" and Inshot power gas burners are available from Hastings Air Control, Inc., Sales Division of Hastings Air Conditioning Co., Omaha, Neb. Covers burner information and selection, specifications and equipment.

Circle **Item 27** on Inquiry Card



Noise Control

A booklet entitled "The Why and How of Noise Control," is available from H. H. Scott, Inc., Instrument Div., Maynard, Mass. Explains the need for noise control in industry and ways of accomplishing it. Includes description of sound measuring instruments.

Circle **Item 28** on Inquiry Card

Air-Electric Floor

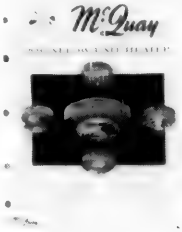
Granco Steel Products Co., St. Louis, Mo., subsidiary of Granite City Steel Co., announces Catalog AE-601 describing its A-E (air-electric) floor. Cut-a-way drawings illustrate operating principles and details of the system. Also includes an air-flow chart.

Circle **Item 29** on Inquiry Card

Gas Fired Unit Heaters

Eight-page Bulletin A-817, describing its line of Series NF propeller fan type gas-fired unit heaters, is available from American Standard Industrial Div., Detroit, Mich. Includes an outline of the design features and operating characteristics of the line.

Circle **Item 30** on Inquiry Card



Downflow Unit Heaters

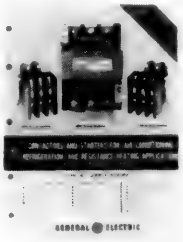
A downflow unit heater catalog, 765-2, has been issued by McQuay, Inc., Minneapolis, Minn. General design and engineering specifications, in addition to steam and hot water rating tables and air distribution information for downflow unit heaters, are discussed.

Circle **Item 31** on Inquiry Card

Control Valves

Conoflow Corp., Philadelphia, Pa., announces the availability of a booklet which compares the features of control valve construction and operation. The 8-page booklet discusses problems facing control valve users and suggests ways they can be overcome.

Circle **Item 32** on Inquiry Card



Contactors and Starters

Bulletin GEA-7316A, a 12-page publication by General Electric Co., Schenectady, N. Y., discusses a line of contactors and starters for air conditioning, refrigeration, and resistance heating applications. Engineering data and design features are included.

Circle **Item 33** on Inquiry Card

Fibrous Glass Insulation

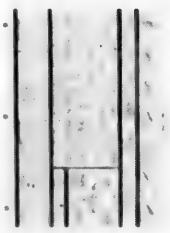
The use of fibrous glass insulation is illustrated in Bulletin F-101 by Fibrous Glass Products, Inc., subsidiary of Pall Corp., Glen Cove, N. Y. Covers thermal insulation, acoustical insulation, vibration isolation, packaging dunnage, and filtration.

Circle **Item 34** on Inquiry Card

Air Handling Troffers

Bulletin B, describing triple-shell Lumi-Flo air handling troffers, is available from Benjamin Div., Thomas Industries, Inc., Louisville, Ky. Covers how Lumi-Flo provides lighting, heating, ventilating, and air conditioning from the same concealed ceiling unit.

Circle **Item 35** on Inquiry Card



Welding Symbols Chart

A chart of basic welding symbols is available from Lenco, Inc., Jackson, Mo. It contains basic weld symbols and their significance, typical welding symbols, supplementary welding symbols, location of elements of a welding symbol, and a list of basic joints.

Circle **Item 36** on Inquiry Card

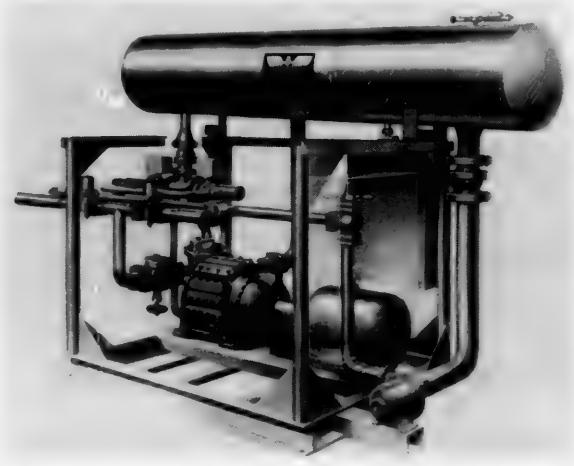
Use the convenient prepaid yellow postcard in the back of the magazine for securing more information about new equipment and materials described in this department.

New Generation Heat Pumps

Worthington Corp, Air Conditioning Div., Harrison, N. J., announces a new generation of commercial heat pumps which offer trouble-free, year-round heating and cooling.

Manufactured specifically for use in the 20 to 300 ton field, the heat pumps are based on positive forced feed circulation of the refrigerant through the respective summer or winter evaporator. No critical superheat control settings govern the operation. The evaporators have a high heat transfer rate and the compressors are fully protected from slugging during operation, switching and defrosting.

The design eliminates 3- and 4-way valves, expansion valves, oil separators and oil receivers, and many other refrigerant controls. Packaging has been achieved so that no installation of refrigerant valves is required.



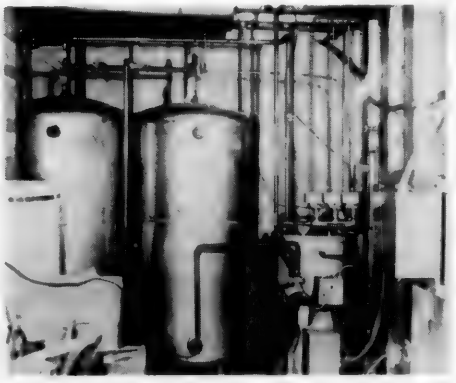
They feature both air to air and air to water operation, replacing conventional heating applications, and are ideal for schools, churches, hospitals, apartment houses, factories, shopping centers and other installations that require heat pump application.

More Information? Circle Item 37 on Inquiry Card.

Off-Peak Hydronic Heating System

An electro-hydronic "off-peak" heating system is announced by Edwards Engineering Corp., Pompton Plains, N. J.

The system is called an off-peak system because it utilizes electrical energy during the night time when electric utilities are not as concerned about peak demands on their lines as they are during the daytime. Immersion coils in the boiler heat up water at night



to temperatures of 150 deg F to 240 deg and store it in storage tanks adjacent to the boiler.

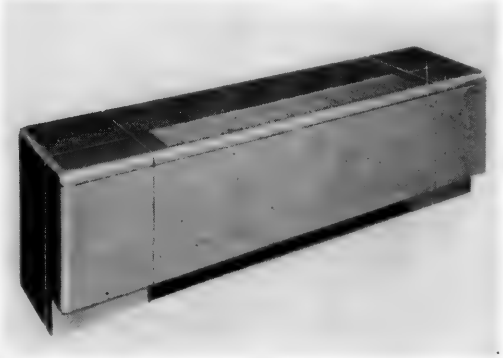
A complete package is offered including boiler, circulator, zone valves, storage tanks and baseboard radiation. Except for the storage tanks, the immersion coil and certain electrical controls, the components are the same as for oil or gas-fired systems.

The system is adaptable for residences and for commercial and apartment buildings.

More Information? Circle Item 38 on Inquiry Card.

Air Conditioning Line Increased

A Lo-Line Seasonmaker, only 12½ inches deep and 14½ inches high has been added to the Seasonmaker line of air conditioners by McQuay, Inc., Minneapolis, Minn. It is available in a flush wall model or in a free standing model which permits draperies to be hung behind it.



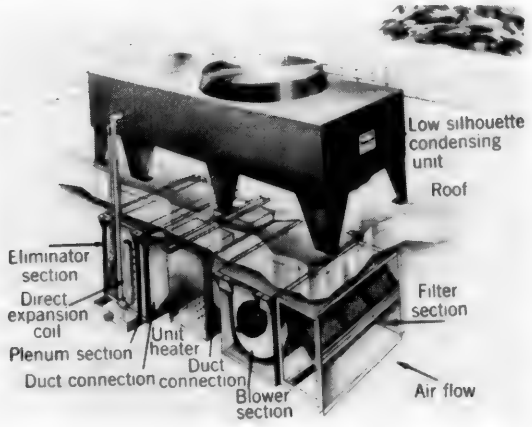
Four sizes from 200 cfm to 600 cfm are available. It has a permanent split capacitor motor, slide out fan deck assembly, motor disconnect plug, large access doors and piping compartments, one inch vinyl coated insulation and air filter removal without front panel removal.

More Information? Circle Item 39 on Inquiry Card.

All-Season Heating-Cooling System

Both heating and cooling are provided by the All-Season system, a product of Dunham Bush, Inc., West Hartford, Conn. The flexibility of this product permits its use in a wide range of buildings: shopping centers; medical clinics; bowling alleys; and many other single story structures.

Space savings are made possible in two ways: low side equipment is suspended from the ceiling (conserving floor space); high side components may be installed on the roof or in a room remote from the conditioned area. Through the use of duct work it is possible to condition partitioned areas or separate rooms.



Features of the system include: packaged components, eliminating expensive field installation costs; central control station providing for remote operation; pilot light for visual check on performance; AGA approved, gas fired, warm air heating system, with no gas lines in the conditioned area; and final piping connections made outside the conditioned area.

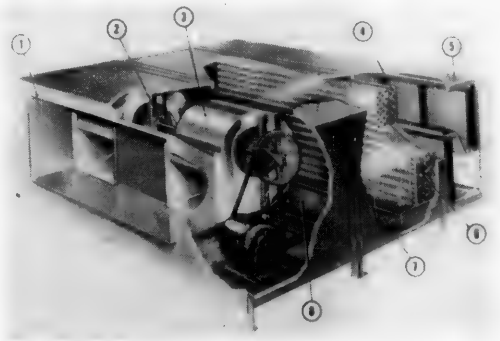
The systems are available in 16 matched combinations. Range: 15 to 30 tons cooling; 175,000 to 450,000 Btu per hr heating.

More Information? Circle Item 40 on Inquiry Card.

Fan-Coil-Filter Unit

A new series of industrial-commercial evaporator-blower-filter units offering capacities of 8 through 35 tons is offered by Lennox Industries, Inc., Marshalltown, Iowa. Units feature versatility of installation, being designed for up-flow, down-flow, or horizontal air delivery, for indoor or outdoor applications.

The dual circuit evaporator coil accomplishes effective humidity control through an inherent face and bypass handling of supply air without the customary expensive complex dampers, damper motors and controls. The coil also offers the advantages of a two-stage system. The large coil section and its separate condensing unit can operate off the first stage of a two-stage cooling thermostat while the smaller section and its separate condensing unit are controlled by the second stage of the thermostat.



The evaporator coil is constructed of ripple-edged aluminum fins, flat-bonded to seamless copper tubes. It is easily removed from the cabinet and may be turned end for end permitting refrigeration line connection at either end of cabinet. An optional steam or hot water heating coil is available, factory installed. Application of direct-fired duct heaters is also feasible.

The blower section consists of twin blowers on a single shaft, powered by whatever motor and drives are needed for the cfm and static requirements of a specific installation. Air volumes of 4,000 to 15,000 cfm are available at static pressures up to 1½ inches of water. The shaft operates in flange mounted ball bearings permitting multi-position mounting of the blower section and positive vertical alignment of the bearings.

More Information? Circle Item 41 on Inquiry Card.

Contactors, Starters Added

General Electric Co., Schenectady, N. Y., announces addition of 20, 25, and 75-amp contactors and starters to its line of air conditioning, refrigeration and resistance heating controls.

The new size offerings supplement the present 30, 40, 50, and 60-amp units, making a total of seven different sizes, all rated up to 600 volts.

The 20 and 25-amp units have a baseplate design which allows for interchangeability with other makes. The 75-amp models feature compact design and out-the-front accessibility for easy maintenance. All forms of this complete line feature straight-through wiring to speed installation.

These controls may be used for all types of air conditioning and refrigeration applications. In addition, all sizes will carry their full amp rating at all voltages on resistance heating loads, allowing for maximum performance.

More Information? Circle Item 42 on Inquiry Card.

Compound Suppresses Vibrations

A viscoelastic damping compound for spraying or trowelling onto metal plate has been proven (by standard Geiger plate test) to provide a vibration decay rate of 55-60 db/sec, as compared with 3-5 db/sec for conventional felts or bituminous mastics. Developed by The Korfund Co., Inc., Westbury, N. Y., the damping material, when applied to metal plate, renders it acoustically equivalent to a sheet of cork, making it an ideal medium for use in suppressing structurally-borne noise and vibration in air conditioning systems.

Designated as Vibrodamper compound, its damping properties offer low cost, solution to problems caused by severe resonant responses of sheet metal structures, (such as air ducts, dampers, pumps, fan scrolls and plenum boxes), to vibration and noise induced

by motors and impellers. Its easy applicability and economy, combined with its unusually high ratio of noise attenuation and noise suppression, makes it well suited for use in office and apartment buildings, hospitals, hotels and factories.

Handled like paint, the compound can be applied to myriad metal surfaces in thin, smooth coats. It dries to an attractive finish (vista green is standard color), is non-toxic, non-flammable, is resistant to alkali, grease, gasoline, and aliphatic oils, and is unaffected by ozone or sunlight. It has an extremely long, effective life, and does not become brittle or change in any way with age. Furnished in 1, 5, 30, and 55 gallon containers. Thirty gallons cover 1300 square feet of area.

More Information? Circle Item 43 on Inquiry Card.

Fallout Shelter Tanks

M. M. Hedges Mfg. Co., Inc., Chattanooga, Tenn., announces a new line of fallout shelter tanks in six sizes from 30 to 100 gal. These tanks, designed to supply uncontaminated water during radioactive fallout, are all glass lined for longer life and may be used in multiples for additional water supply.

More Information? Circle Item 44 on Inquiry Card.

Filter Kits For Fallout Shelters

Enlargement of its line of Absolute filters and ventilation equipment for fallout shelters is announced by Cambridge Filter Corp., Syracuse, N.Y. For many years the filters have been used to remove radioactive dust, airborne bacteria and viruses, as well as toxic chemical dusts. They were originally developed to remove radioactive particles from the exhaust of Atomic Energy Commission plants.

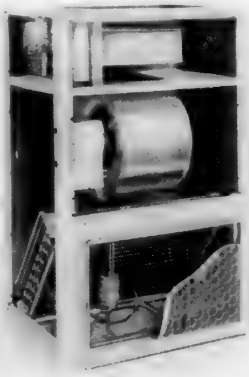
A waterproofed glass-asbestos medium is used in these filters. This is formed into a closely pleated package with aluminum separators. Frames are of hard board construction with aluminum pipe fittings. The manufacturer reports these materials will permit satisfactory operation even under conditions of high humidity. The filter is available in a number of sizes to meet shelter ventilation requirements.

Filters are tested and guaranteed to have an efficiency of not less than 99.97% when tested on 0.3 micron diameter smoke particles. Complete kits including filters, blowers, and flexible duct are offered in various sizes and capacities.

More Information? Circle Item 45 on Inquiry Card.

Furnace Features Slide-In Coil

Two electric furnaces, designed for residential and small commercial installations, are introduced by Chrysler Airtemp Div., Chrysler Corp., Dayton, Ohio. Model 4933 has a 33,000 Btu capacity and Model 4966 distributes 66,000 Btu per hr.



The furnaces are designed for horizontal, vertical or counterflow operation and contain a three-speed, direct drive blower. They feature a space designed for a slide-in cooling coil. The original blower and blower motor are of adequate capacity for the addition of the coil.

The addition of a cooling coil transforms the furnace into the indoor section of a split-system air conditioner or a heat pump. In the latter case the electric heat serves as auxiliary heat in the system. The location of the cooling coil upstream to the heating units insures the most efficient heat pump operation.

Exterior dimensions on both furnaces are identical. In a vertical position the furnaces are 29½ inches wide; 19½ inches deep; and 48⅛ inches high.

More Information? Circle Item 46 on Inquiry Card.

Through-The-Wall Heating Unit

A through-the-wall heating unit, designed for easy addition of a self-contained cooling or heat pump package, has been placed on the market by Carrier Corp., Syracuse, N.Y.

Called the Thru-the-Wall Weathermaker, the unit can heat by steam or hot water from a central boiler, by electric resistance, or by the combination of a heat pump and electric resistance. A low-cost, self-contained cooling or heat pump package can easily be installed at the time of installation or in the future, and is inserted through the wall and plugged into a control box.

The basic unit contains a two-speed centrifugal fan, a coil for steam or hot water heat or an electric grid for resistance heat, and an automatic control panel. To add cooling at the time of installation or later, a specially designed refrigerating package with one horsepower capacity fits into the wall sleeve supplied with the original unit. The heat pump assembly also fits the wall sleeve in the electric heat pump model. If outside temperature drops to 25 degrees, a thermostat shuts off the heat pump and the resistance heater operates alone.

All parts are easily accessible, and all steel components are zinc-coated for corrosion resistance. A throw-away filter collects dust and dirt from the air, and movable directional grilles on top of the cabinet provide a variety of air deflection patterns.

More Information? Circle Item 47 on Inquiry Card.

Motorized Zone Control Valve

A series of straight-through flow hydrozone motorized zone valves for use on hydronic heating and cooling systems, and for steam up to 10 psi, is being manufactured by A. W. Cash Valve Mfg. Corp., Decatur, Ill.

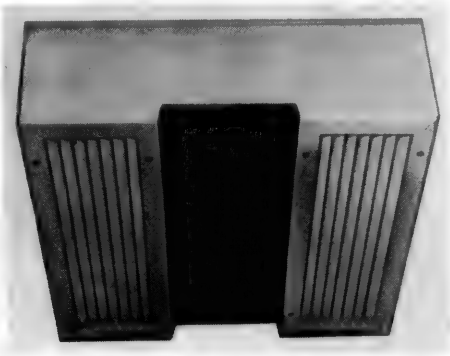
Special features of the valves are: Visual valve stem indicator, to eliminate leaking at the valve stem; a special Viton "O" ring; and 100% shutoff, thus allowing the valves to be used on low pressure steam systems.

The series comprises two models of straight-through flow design: The Type X-108, with ¾-inch sweat copper inlet and outlet; and the Type Z-208, with 1-inch sweat copper inlet and outlet.

More Information? Circle Item 48 on Inquiry Card.

Movable Ceiling Air Vent

An air vent designed to be used in conjunction with movable walls and partitions is announced by Air-Conditioning Department of Industrial Acoustics Co., New York, N. Y.

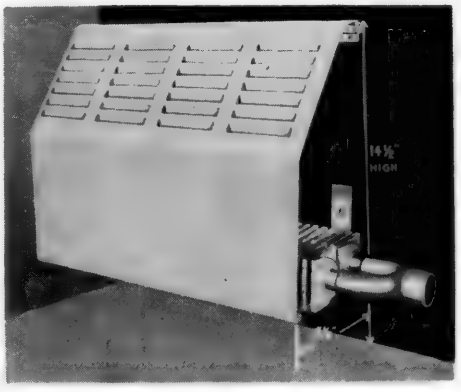


These units, which permit the circulation of air while preventing the passage of sound, are designed to fit over the partition or movable wall and into the ceiling where they take the place of a standard ceiling 24 inch x 24 inch tile. As a result, the unit can easily be relocated at the same time as the wall or partition is moved.

More Information? Circle Item 49 on Inquiry Card.

High Output Twin-Tube Baseboard

Edwards Engineering Corp., Pompton Plains, N. J., announces its box-fin twin-tube hot-water baseboard radiation, which incorporates two standard box-fin radiation elements side-by-side in a redesigned enclosure.

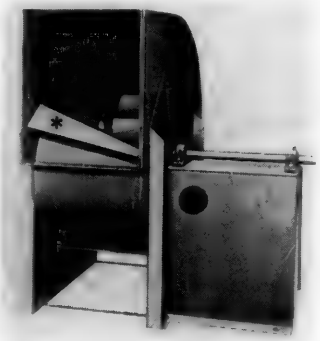


Ratings of 1320 and 1000 Btu per ft are available at 200 and 180 deg F water temperature respectively at flow rates of 4 gpm. Covers are 14½ inches off the floor and 5½ inches deep from the wall. A U-fitting for manifolding the ends of the parallel tubes is available.

More Information? Circle Item 50 on Inquiry Card.

Fan Design Improves Efficiency

The Trane Co., La Crosse, Wis., announces a line of 12-blade airfoil fans featuring a new blade design, improved inlet cone and wheel rim design, plus a new type of air cutoff. These features have resulted in a maximum of 91 per cent total efficiency rating for the line, according to Trane.



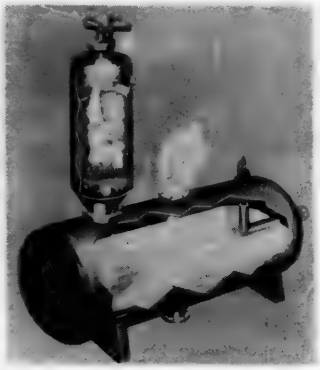
The airfoil blade has a very slight camber and a blade thickness that is 12% of the blade's chord. This relatively thick blade contributes to higher fan efficiency. The inlet cone and wheel rim were designed to work together. The contour of the inlet cone permits air entry with a minimum of shock and turbulence. Power-wasting eddies are eliminated.

The air cutoff was designed to create a more uniform flow of discharge air and reduce recirculation of air between the housing sides and the fan wheel. In operation, the sloping rolled cutoff peels the air off fan blade edges. It progressively intercepts the air along each point of the blade edge. Air from the inlet end of each blade contacts the highest point of the sloping cutoff. As the last of each blade passes the lowest point of the cutoff, air from the inlet edge of the next blade is already contacting the high point of the cutoff. The result is a more even velocity distribution across the fan discharge, the company states.

More Information? Circle Item 51 on Inquiry Card.

Deaerator Reduces Oxygen Content

Corrosive oxygen in boiler feed water is reduced to less than .005 cc/liter in a packed column deaerator developed by Aqua-Chem, Inc., Waukesha, Wis., affiliate of Cleaver-Brooks Company.



The Boilermate deaerator spreads the raw water into thin layers by means of a self-cleaning spray nozzle and a tray-type exchange packing. Steam, moving in counterflow to the water, scrubs out the dissolved oxygen and carbon dioxide, which cause corrosion of boilers, feed lines, and condensate return lines.

Available in seven models with ratings from 1,500 lbs an hr at 50 deg F to 55,000 lbs at 150 deg. Carbon steel storage tanks for deaerated water range in capacity from 53 to 1,012 gal.

In addition to protecting boiler equipment from corrosion, the deaerator offers these advantages: Automatic variable vent, for discharging gases to the atmosphere with a minimum of steam losses; operation on waste exhaust steam at 5 lb pressure, as well as on steam from the boiler; improved performance of process equipment due to removed air, which acts as an insulator in the water; and an exchange packing, which exposes a maximum amount of water surface to the steam, and at the same time requires no service or maintenance.

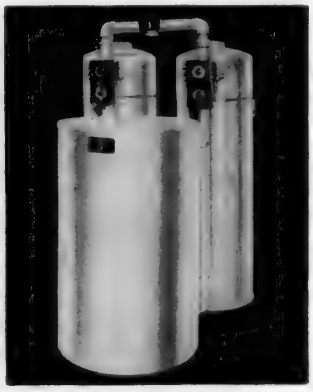
More Information? Circle Item 52 on Inquiry Card.

4,200,000 Grains Removed Per Week

A 5 cycle, softening, filtering and refining, unit has been developed by Water Refining Co., Inc., Middletown, Ohio, for commercial and industrial use. It has a flow rate capacity of 100 gpm with water pressure at 40 psi.

The Miracle Water Tri-Matic MA 600 FF model offers 3-units-in-1 to soften, filter and refine, remove hardness, rust, and stain-causing impurities. Operation is completely automatic, controlling electrically, times and frequency of regeneration.

Capacity can be doubled by addition of modular units tied into the unified system. The equipment will pass through a 29-inch doorway and may be installed in confined space or separated areas. Flow rates and hardness removal capacities are virtually unlimited through adding of modular units.



Multiple resin beds assure continuous supplies of softened, filtered, refined water with no interruption during regeneration. The unit has a basic capacity of 4,200,000 grains of hardness removed per week. Operating economies in salt usage, electricity, and water for regeneration approximate 30%.

More Information? Circle Item 53 on Inquiry Card.

Gas-Fired, Hot Water Boiler

Cleaver-Brooks Co., Milwaukee, Wis., announces the commercial availability of a new line of small, compact, gas-fired, hot water boilers.

Named Beaver, the line consists of 16 sizes ranging in capacity from 200,000 to 3,000,000 Btu per hr. They can supply hot water for building heating, for hot service water, for heating swimming pool water, and for year-around heating and air conditioning systems. Vertical coils can be added to handle the variety of applications. Typical applications include small schools, motels, apartment buildings, restaurants, swimming pools, shopping centers and similar installations.

The cabinet is 18 gage steel and the base is 14 and 12 gage. The base is dimpled to keep off the floor and prevent corrosion. The anti-stress design eliminates the problem of thermal shock. Temperature differentials cannot create leakages.

Either on-off firing or high-low firing are offered in controls. In either case, firing is quiet without danger of puff back. One gas valve is used for on-off firing; two are used for high-low firing, both valves are open on high fire, only one is open on low fire. Standard controls include electric gas valve, pilot safety control, gas pressure regulator, gas shut off valve, ASME rated relief valve, combination thermometer and altitude gauge, aquastat. All firing controls and burners are fully enclosed within the metallic jacketing.

More Information? Circle Item 54 on Inquiry Card.

Laminated Construction Material

The availability of a new type of construction material, called Kaylite, is announced by Kaykor Products Corp., Yardville, N. J. Kaylite represents an entirely new type of laminate which combines the advantageous physical properties of fiberbase laminate with the many physical as well as chemical properties of rigid polyvinyl chloride.

In addition to its outstanding chemical resistance, Kaylite may be exposed to both higher as well as lower temperatures than are recommended for rigid polyvinyl chloride. This is due to the fact that the structural strength is provided by the fiber-base laminate core, which offers a stable foundation into which the laminated polyvinyl chloride surfaces.

It can be formed and fabricated by methods common to the sheet metal and plastic trade and can be joined to itself by chemical adhesives as well as the hot-air welding method for thermoplastic materials. It has a specific gravity of about .85 and offers relatively structural strength to permit self support insulations.

Current applications include air conditioning ducts (due to its excellent thermo and acoustical insulating characteristics), chemical ducts and hoods, tank covers, formed parts such as pans, trays and machine guards. It can be used as anti-corrosive wall protection since no base preparation is necessary.

More Information? Circle Item 55 on Inquiry Card.

Time and Program Controllers

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., introduces a master time and program controller that features simplified operating controls and new clock and case designs.

The units provide master program or master time and program control in a single swing-out case. They can ring bells, dim or extinguish lights, turn ventilating units on and off, turn security systems on at night and off in the morning, and handle other jobs on a programmed basis.

The master controller can handle 100 clocks. To control additional clocks, relays can be added to the circuit. The master clock system is available in 24 or 120v a-c or 24 or 60v d-c. It provides minute-hand corrections every hour and hour-hand corrections twice each day. Systems can include an optional spring motor to run the master clocks for 24 hours after a power failure.

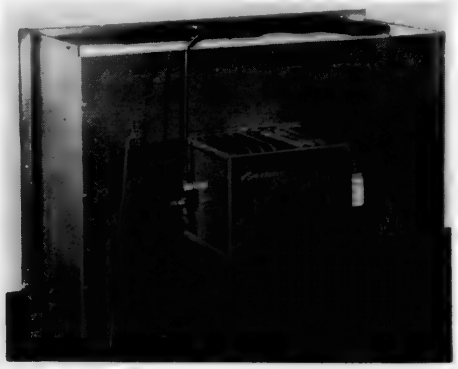
Programmers are available for 1-minute or 5-minute interval signaling on a 24-hour basis. Signals can be set any duration from 2 to 25 seconds. If desired, an extra contact is available for sounding some signals longer than others. They can also include a cycle device for ringing single-stroke chimes.

More Information? Circle Item 56 on Inquiry Card.

Commercial Humidifier Announced

A humidifier, sized between residential models and large industrial models in its line, is announced by Research Products Corp., Madison, Wis.

The humidifier, Model 118 Aprilaire, is designed for use with forced air heat; for installation on a plenum; or for mounting on a horizontal duct. It has a capacity of 38 lbs of water per hour, making it suitable for installation in commercial establishments such as theatres, bowling alleys, printing plants, and offices.

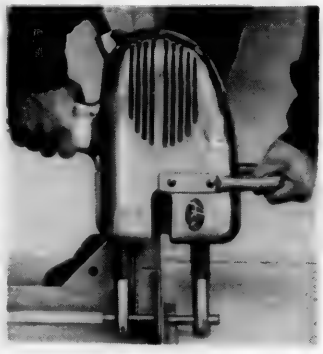


In the forced humidification principle, water is evaporated from a water panel so that moisture is introduced as a vapor, and mineral deposits are either trapped by the panel or washed down the drain. This eliminates maintenance problems caused by liming of working parts and the possibility of "white dust" being distributed. Control is by humidistat, which activates the unit when required, and shuts it off when the humidity setting has been reached.

More Information? Circle Item 57 on Inquiry Card.

Portable Resistance Spot Welder

A portable, resistance spot welder, with built-in timer and other features, is introduced by Ace-Sycamore, Inc., Sycamore, Ill.



The capacity is $\frac{3}{16}$ inch for cold rolled steel and up to $\frac{1}{8}$ inch combined thickness for stainless, galvanized and cadmium plated steel. Sheets, rods, bars and studs of many sizes and shapes can be welded. In light production, as many as 200 to 300 welds per hour can be made, depending upon the type and gage of material.

Outstanding features include: An electronic timer with adjustments from 1/60 second to a full second; 100 ampere contactor; independently suspended and insulated transformer; 1000 pounds pressure at tips of electrodes; and up to 3-inch tip opening with 7-inch throat depth.

The transformer is heavy-duty, twin type, air cooled, with a secondary rating of 2 volts and 8200 amp short circuit. Over-all size is 12 x 13 x 5 inches wide. Weight of welder is 26 pounds.

More Information? Circle Item 58 on Inquiry Card.

Portable Metal Buildings

A new line of small metal buildings, suitable for wide application in the air conditioning, plumbing and heating trades, is introduced by Parkersburg Building Div., Parkersburg, W. Va.

Designed for immediate delivery and quick field assembly, the all metal structures are applicable as warehouses for storage of air conditioning, heating or plumbing stocks, shelters for commercial air conditioning equipment, fire protection equipment shelters, contractors offices, or as garages for vehicle or maintenance equipment storage.

Available in any length, the buildings are made in clear span widths from 4 to 32 ft and in heights from 7 to 14 ft. They can be skid mounted to permit portability from one job site to another. The use of contrasting colors on the door, roof and wall panels

enhances the appearance. The colors are made possible by the use of Duracron finish, a thermo-setting acrylic resin which combines the following properties in a single finish: Superior adhesion, impact resistance, humidity resistance, salt-spray resistance, water soak resistance, grease and stain resistance and outdoor durability.

A complete line of standard accessories is available for the buildings including: Swing, overhead and sliding doors; stationary commercial, and sliding type windows; and stationary or ridge-type ventilators. Also available are ceilings and partitions, wall lining and insulation, translucent skylights, gutters and downspouts.

More Information? Circle Item 59 on Inquiry Card.

what makes

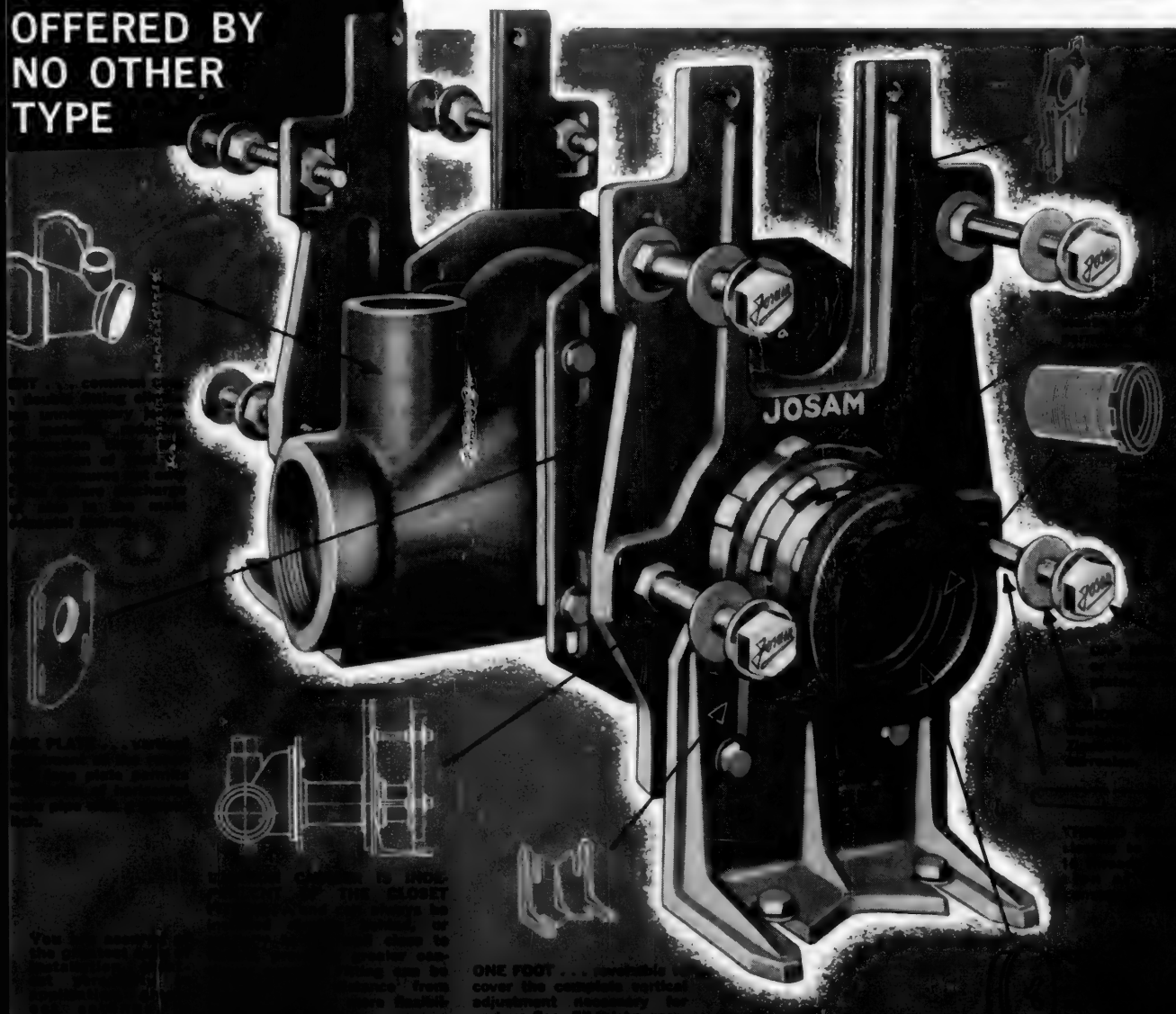
Josam **UNITRON**®

CARRIERS AND CLOSET FITTINGS

FOR OFF-THE-FLOOR CLOSET INSTALLATIONS

so much better
so much easier to install

A COMBINATION
OF
OFFERED BY
NO OTHER
TYPE



ONE FOOT . . . provides [illegible] cover the complete vertical adjustment necessary for various floor fill thicknesses.

JOSAM MANUFACTURING CO.

General Offices and Manufacturing [illegible] Michigan City, Indiana

REPRESENTATIVES [illegible] CITIES

West Coast [illegible]

JOSAM PACIFIC CO.

765 Folsom Street [illegible]

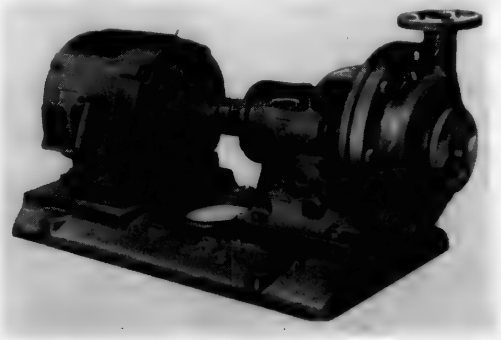
JOSAM PRODUCTS ARE SOLD [illegible]

Manufacturers and Representatives [illegible]

Glassed Pump Reduces Corrosion

For highly corrosive pumping jobs involving relatively small capacities, up to 75 gpm, Goulds Pumps, Inc., Seneca Falls, N.Y., has available a 1-inch size glassed pump, Model 3706.

Glass, fused to metal, on all surfaces coming in contact with the pumpage, provides almost complete resistance to corrosion, eliminates contamination of product and adherence of product to pump parts. All glass surfaces are continuous with no bolt holes or tapped openings. A confined Teflon envelope gasket between casing and casing cover provides a corrosion-



proof and leak-proof joint. With the quench gland and bearing cooling chamber, liquids up to 350 deg F can be handled.

Grease lubricated ball bearings are standard with oil lubricated bearing construction optional. The fully open type impeller is designed for glassing and has an extended hub which protects the stainless steel shaft from the pumpage. Hub extends beyond stuffing box gland eliminating any joint within the pump; always a possible source of leakage along the shaft.

More Information? Circle Item 60 on Inquiry Card.

Flexible Urethane Pipe Insulation

Production of a highly flexible urethane pipe covering, Hewflex, which offers exceptionally high insulating efficiency for liquid cooling and heating lines, chilled water lines and other lines commonly used in refrigeration, air conditioning, plumbing, heating and industrial processing operations, is announced by H. E. Werner, Inc., Bethel Park, Pa.

Hewflex has a cellular structure which gives it a low k value, making it extremely effective as a pipe insulation throughout a wide temperature range. It is unaffected by moisture, seals out air and vapor, and prevents condensation.

Hewflex is designed to slip onto uninstalled pipes or snap around piping already installed. It can be applied to hot or cold lines without disrupting service. No special tools are required.

More Information? Circle Item 61 on Inquiry Card.

Pipe Grade Polypropylene Resin

Avi-Sun Grade 1051, an improved pipe grade polypropylene resin, is announced by Avi-Sun Corp., Philadelphia, Pa.

The polymer will process into pipe over a broad range of conditions with little change in strength and impact properties. One of its most important advances over standard polypropylene is its improved stress-life at elevated temperatures.

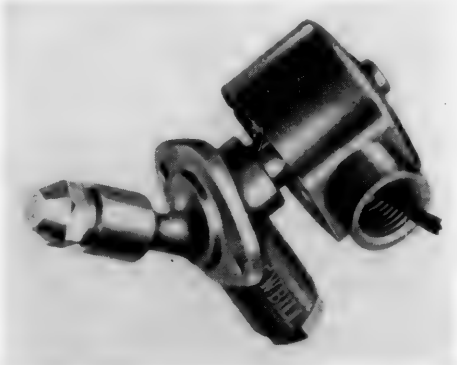
Tested extensively in the laboratory and in oil field and chemical installations throughout the country, pipe extruded from Avi-Sun 1051 has been found to offer a unique combination of physical, thermal, chemical and electrical properties, coupled with ease of fabrication and low product costs. It is also approved for potable water use by the National Sanitation Foundation.

More Information? Circle Item 62 on Inquiry Card.

Humidifier Has One Moving Part

An improved low cost humidifier for forced air heating systems, having the capacity to maintain comfortable conditions in a 6 or 7 room dwelling during the winter months, is made available by Lewbill Industries, Inc., Scottdale, Pa. It is of the atomizing type, operating only when the furnace blower is in operation. The cone-type atomizing nozzle, powered by existing water pressure, introduces an extremely fine mist into the heating system which is evenly distributed throughout the rooms.

The humidifier contains only one moving part. There are no evaporator plates to replace, no water overflow and no residual water loss that is common with conventional humidifiers. It operates on 110v a-c and delivers up to .85 gal of water per hr of con-



tinuous operation. A minimum of 40 psi water pressure is required for satisfactory nozzle performance. Where the furnace blower is continuously operating, the addition of a humidistat will control the humidity to the desired degree.

More Information? Circle Item 63 on Inquiry Card.

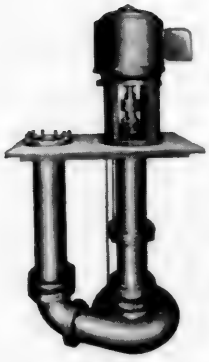
"from Chicago"

A complete line of Vertical Enclosed Shaft Non-Clog Pumps

FOR HEAVY DUTY PUMPING OF SEWAGE, SUMP AND STORM WATER, CONTAINING SOLIDS

Chicago pumps are durably built units featuring micrometer ball bearing adjustment of rotating elements, tongue and groove registering, and oversized bearings. The Chicago two port non-clog impeller remains in natural hydraulic balance thruout the pumping cycle. All impellers are also dynamically balanced.

Manufactured by Chicago Pump, with over 52 years of unequaled experience in the design and manufacturing of non-clog pumps. Backed by a reputation for excellence in design and outstanding service to its thousands of satisfied customers. Write for Bulletin 124-G.



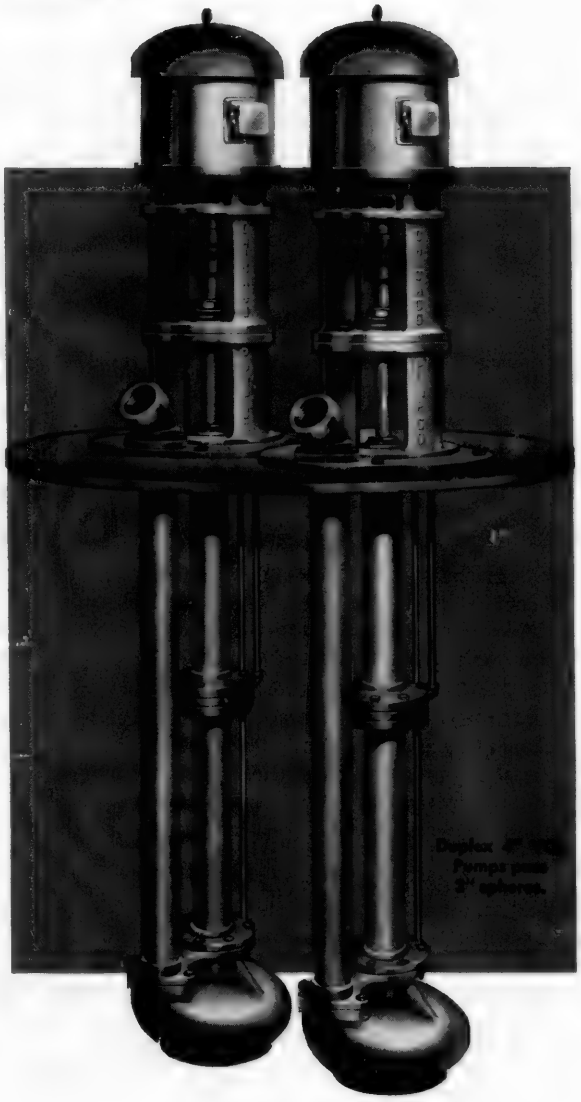
10" VCS
Pumps pass
5" spheres.

HIGHER CAPACITY VCS PUMPS

Pumps range from 4" thru 10" discharge size available for single or duplex installation. All pumps incorporate the same high grade materials and machined tolerances for extended life.

EXCLUSIVE SEALTRODE

"Sealtrode", sealed electrode floatless pump controller is a dependable control for any installation. Electrodes cannot become coated or insulated with grease, oil, soap or solids. Elements never corrode as they are sealed from the liquid being pumped.



Capacities: 50 to 5000 GPM
Heads to 105 feet.

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HYDRODYNAMICS DIVISION

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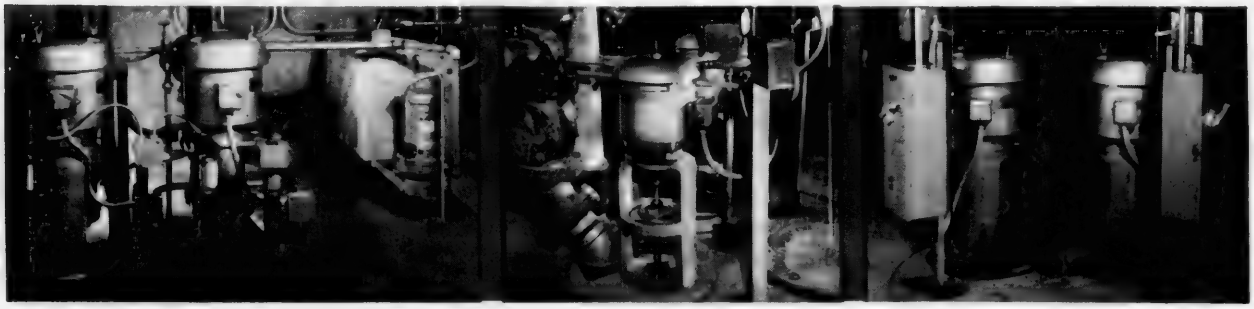
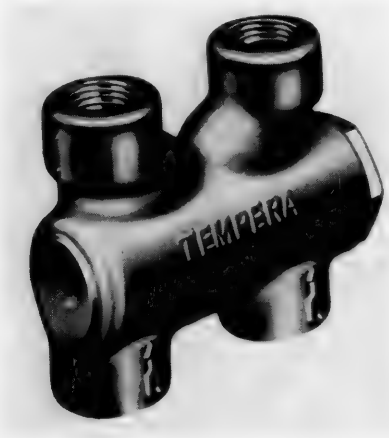


Scald Proof Shower Valve

An inexpensive valve that will maintain a constant water temperature control for showers and other water outlets, to within one degree, is being marketed by Tempera Corp., Portland, Ore.



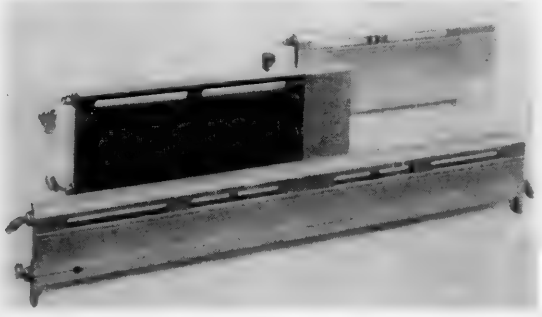
It has an overall length of 3⅞ inches and overall height of 3⅛ inches. It is composed of only four parts: A bronze body; a perforated sleeve; a hex body nut; and a perforated piston, the latter being the only moving part.

The Tempera is a balancing line valve, operated by water pressure. Once the water temperature is adjusted to an individual's taste, and then altered by a water pressure change, the piston will move back and forth, decreasing or increasing the hot or cold water flow, depending on pressure changes in the supply line.

More Information? Circle Item 64 on Inquiry Card.

Hydronic-Electric Heating System

A heating system, described as a new concept in heating, combining the best features of hydronic and electric heating, is made available by Aqua-Lectric, Inc., Minneapolis, Minn.



The heating system uses cast baseboard radiation, with electrical energy supplying the heating power. The electric heat producing element is within the radiation chamber, with the liquid in the chamber transferring the energy from this element to the radiant heating surface.

Boilers, furnaces, fuel storage systems, heating ducts, gas service entries, flues or chimneys, and such accessories as circulating pumps, flow fittings, distribution pumps and special wiring are eliminated.

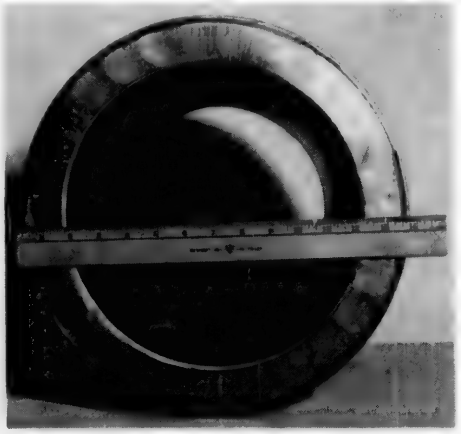
The system provides temperature control within ¼ of a degree at all times room by room or zone by zone. This is made possible through the use of two control units working in unison. A low-mass, exceptionally-responsive wall thermostat in each room or zone provides rapid, frequent heat signals to a heat anticipating relay in the master control panel. This thermostat-relay combination precisely anticipates comfort requirements, and electric heat is increased or decreased before any changes can upset the comfort balance.

The units are available to cover any length and all installation requirements, and connections can be made at either the right or the left of the baseboard panels.

More Information? Circle Item 65 on Inquiry Card.

Chimney Doubles Venting Capacity

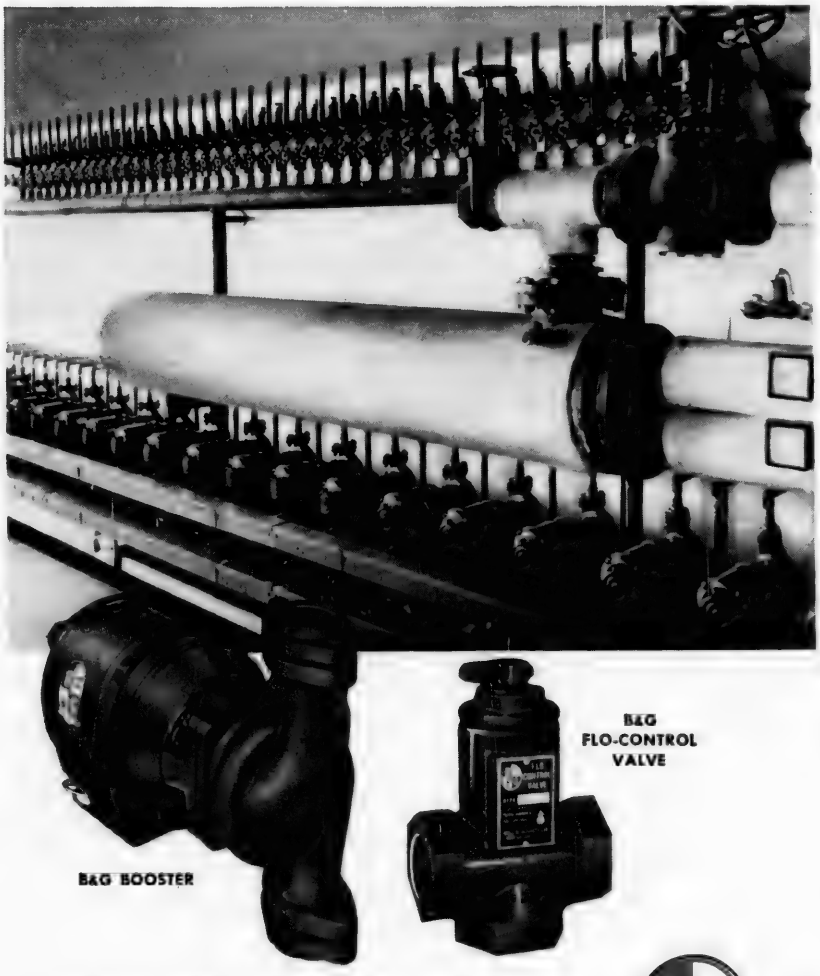
Metalbestos Division of William Wallace Co., Belmont, Calif., is manufacturing an all-fuel chimney, which the firm claims can support, in standard framing, twice as much venting capacity as any chimney with the same OD. Designated Model 10-K, the chimney has an ID of 10-inches and a total venting area of 78.5 sq inches. It has an outside diameter of 14 inches and is listed by Underwriters' Laboratories,



Inc. for installation at 2 inch clearance to enclosures and one inch clearance to roof structure. Its applications include oil, coal, wood and gas burning equipment, as well as incinerators and fireplaces.

More Information? Circle Item 66 on Inquiry Card.

NEAR THE ARCTIC CIRCLE 40 B&G BOOSTERS GIVE RESIDENTS INDIVIDUAL TEMPERATURE CONTROL



B&G BOOSTER

B&G FLO-CONTROL VALVE

The B&G Booster is engineered for compactness, *silent operation* and years of service. It is built by precision manufacturing methods which translate good design into a superior product. Over 3,500,000 have been installed to date.

The B&G Flo-Control Valve is so designed that it can be easily cleaned without removing it from the pipe line.

At Fairbanks, Alaska, tenants in the Anderson Apartments enjoy all the comforts of *radiant Hydro-Flo* heating plus their own choice of temperature. Each apartment is on a separate heating zone and has an individual thermostat to control the operation of a B&G Booster pump. In each circuit, a B&G Flo-Control Valve prevents the possibility of an over-ride in heat.

A 2-pass B&G steam-to-water converter provides hot water for the heating system.

B&G Boosters are designed and built specifically to meet the exacting demands of circulated water heating and cooling systems. Their freedom from maintenance problems as well as quietness of operation explain why B&G Boosters are the preferred pumps.

THE BUILDING:
Anderson Apartments, Fairbanks, Alaska

ARCHITECT:
Philleo Engineering Co.

HEATING ENGINEER:
Fairbanks Plumbing and Heating

PLUMBING AND HEATING:
Fairbanks Plumbing and Heating

GENERAL CONTRACTOR:
Kenneth P. Anderson, Contractor

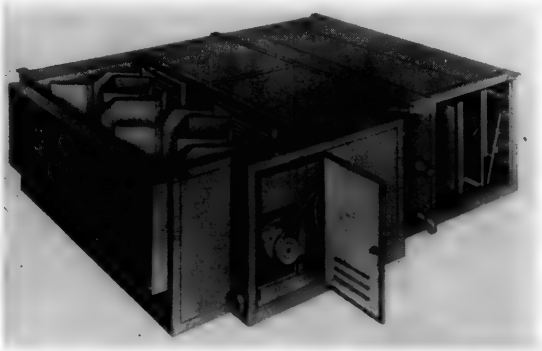
BELL & GOSSETT
COMPANY
Dept. GX-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Ventilator Has Low Noise Level

An auditorium unit ventilator, the Herman Nelson Audivent, is introduced by American Air Filter Co., Inc., Louisville, Ky. It is available for steam, hot water or electric applications, in sizes to suit applications in the school—auditorium, gymnasium, cafeteria, and swimming pools. It can be converted to immediate or future year round air conditioning.

Outstanding feature of the ventilator is its quiet operation. A sound attenuator has been added to each



unit. It is lined with 1-inch thick glass fiber insulation bonded with a thermo-setting plastic resin. Design and placement of the baffles provides 12 to 18 sq ft of absorption surface for each 1000 cfm. Absorption surface is of a density so as to achieve a noise reduction coefficient of .70 to .80 in the range of 125 cps to 4000 cps.

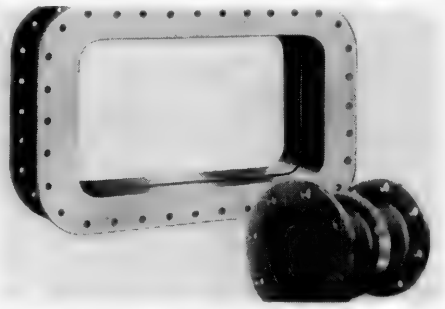
Other features include an enclosed motor and drive, readily accessible through hinged access doors; nine sizes in the low pressure range and seven in the high pressure range; unit ventilator control cycles, available for auditorium units; freeze-proof system, with the addition of a special mixing vane in the mixing damper section; automatic backdraft dampers, which prohibit entry of cold outdoor air in the return air ducts; and neat, convenient electric connections.

More Information? Circle Item 67 on Inquiry Card.

Rubber Expansion Joints

Crane Packing Co., Morton Grove, Ill., offers a complete line of rubber expansion joints to industry. Made from a specially developed high-grade abrasion-resistant rubber that has been compounded for maximum flexibility and non-set characteristics, they are suitable for a wide range of applications.

Joints are reinforced with heavy-weight duck to give extra toughness and service and are coated on the outside with neoprene to prevent oxidation or damage from oil or grease. Joints are also available with an internal neoprene lining or are made from neoprene throughout. Rubber flanges are an integral part of the body. This one piece construction provides easy installation and assures a tight seal, without gaskets, due to the resiliency of the rubber.

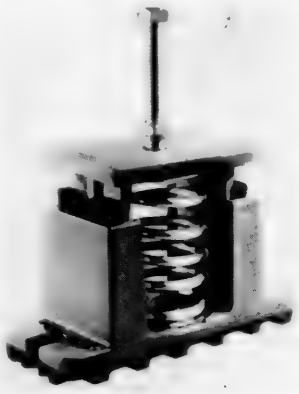


Standard spool type joints are available for pipe sizes from 2 to 72 inches. Vacuum type joints are designed for 30 inches of mercury and pressure type joints for 0 to 150 psi, depending on size. Special joints can be designed in tapered, rectangle, oval or other shapes to handle acids, gases, and chemicals.

More Information? Circle Item 68 on Inquiry Card.

Spring Mounting Stops Vibrations

A compact spring isolation mount cuts equipment installation time as much as 50%, maintains machinery efficiency, and stops vibration, shock, and structural noise transmission, according to its manufacturer, The Korfund Co., Inc., Westbury, N. Y.



The mounting, an isolator utilizing a single helical coil steel spring as the cushioning medium, is available in load-carrying capacities of 50 to 540 lbs. This wide range is provided by a selection of four different springs which can be inserted into the isolator housing.

The cast semi-steel housing measures 3¾ x 3¼ x 5⅛ inches and has an access port on each side, which permits interior inspection, facilitates cleaning, and enables the spring to be changed in the field without dismantling the installation.

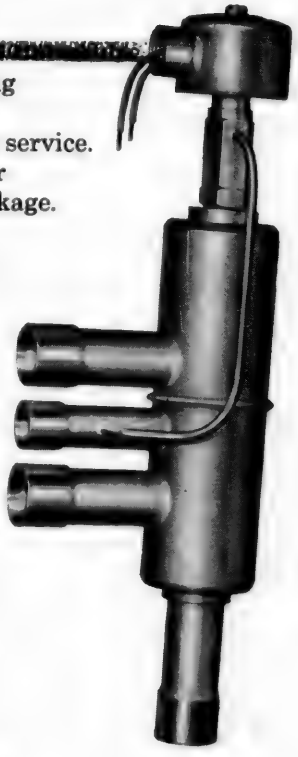
The mounts were developed to stop vibration transmission from fans, cooling towers, motor generator sets, furnaces, pipe supports, turbines, and packaged air conditioning and air handling units. They are equally effective in protecting machine tools, instruments, and other precision equipment against vibration and shock.

More Information? Circle Item 69 on Inquiry Card.

Buy SPORLAN

REVERSING VALVES
THERMOSTATIC EXPANSION VALVES
REFRIGERANT DISTRIBUTORS
CATCH-ALLS
SEE • ALLS

for HEAT PUMP *peak performance*



Sporlan Reversing Valves the reliable 4-way change-over control with the new Floating Ring design. Proven synthetic seating material assures complete tightness under all operating conditions throughout many years of service. No close fitting metal-to-metal sliding seals to wedge, corrode or wear, with resultant erratic performance or by-pass leakage.

Sporlan Thermostatic Expansion Valves are specifically designed for heat pump applications with elements made to meet their unusual operating requirements. Rugged in construction to withstand high pressures . . . with diaphragms designed for long life. Special selective charges maintain control of the system under extreme variations of ambient temperatures.

Only Sporlan Offers Refrigerant Distributors with auxiliary side connections for reverse cycle applications . . . plus the versatile interchangeable nozzle that gives you peak coil performance on heat pumps.

The Sporlan Catch-All is the perfect filter-drier for heat pumps. Ample water capacity...unexcelled in acid removal...with the famous molded porous core that retains those extra fine particles which cause abrasive damage or troublesome leakage. Only Sporlan Catch-Alls give you really clean, really dry, acid free refrigeration systems.

With a Sporlan See•All you can check the refrigerant in a heat pump system at a glance, because it's the moisture and liquid indicator with the single dot that shows how dry the refrigerant is . . . and the full view sight glass that lets you see if the system is fully charged.

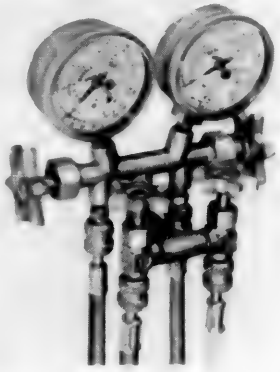
Contact us today for additional engineering data

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST LOUIS 17, MISSOURI

EXPORT DEPARTMENT, 85 BROAD STREET, NEW YORK 4, N. Y.

4-Way Testing Unit

Madden Brass Products Co., Aurora, Ill., announces production of a 4-way testing unit that allows evacuation, charging and testing of any commercial, domestic, or automotive system without disconnecting from the refrigerant supply or the vacuum pump. With this unit, the need to blow out with costly refrigerant after pulling vacuum is eliminated.



Four valves, all with positive, easy-seal nylon seats and teflon packings, give control of entire purging, testing and charging operation. These units feature sturdy, compact, forged brass bodies and metal hand wheels.

More Information? Circle Item 70 on Inquiry Card.

Dissolved-Oxygen Analyzer

The DO-100, a continuous dissolved-oxygen analyzer, is made available by Wallace & Tiernan, Inc., Belleville, N. J. The analyzer accurately and continuously measures and records micro quantities of dissolved oxygen in boiler and other high-purity water systems. It is electro-chemical and direct-acting.

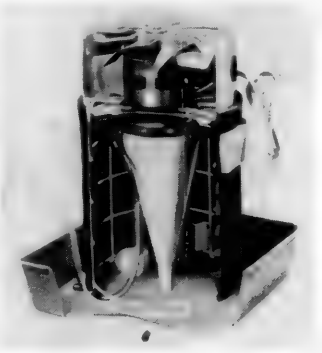
Dissolved - oxygen reacts with measuring electrodes in a sampling cell. An electric current proportional to the amount of oxygen in a continuous sample is generated. This current operates an indicator (calibrated 0 to 25 or 0 to 250 parts per billion) from which a signal may be transmitted to any standard millivolt recorder.

Precise control of sample-water flow temperature, and conductivity assures readings accurate to ±5% of full scale. An oxygen change as small as .1 part per billion registers within 5 to 10 seconds after the sample enters the instrument. The analyzer has a wide operating range and is calibrated without chemical analysis.

More Information? Circle Item 71 on Inquiry Card.

High Capacity Humidifier

A humidifier that evaporates a high volume of water, and also traps dust, water minerals and water soluble odors (including tobacco smoke), is being marketed by Associated Mechanical Services, Inc., St. Paul, Minnesota.



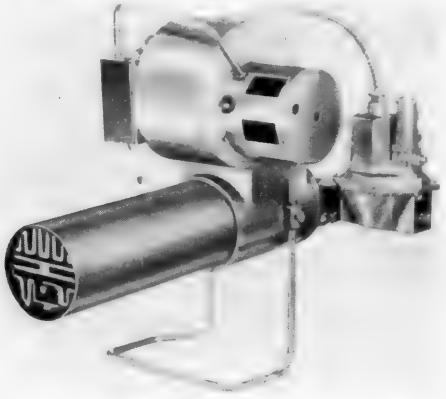
Centrifugal action of a quietly spinning cone picks up water from a reservoir pan and throws it against a breaker comb. This water saturates a high-porosity evaporating mat enclosing the unit. A self-contained fan pulls dry air into the unit's interior and forces it out through the moisture saturated mat at a relative humidity of 90 to 95%.

It can be easily installed in any home or commercial building regardless of the heating system now in use. It is made of non-corrosive materials throughout, stands 20 inches high and weighs 27 lbs.

More Information? Circle Item 72 on Inquiry Card.

Power Gas Burner

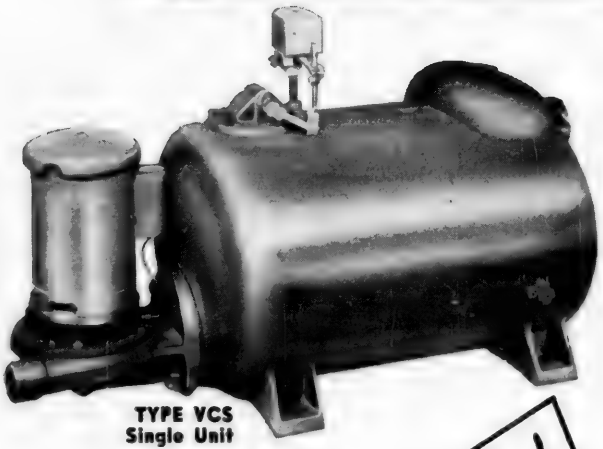
Mid-Continent Metal Products Co., Chicago, Ill., offers for immediate delivery a larger version of its Economite power gas burner. The new No. 800 burner has a capacity of 800,000 Btu per hr. With the addition of this model, Economite Burners now cover a capacity range of from 75,000 to 800,000 Btu per hr.



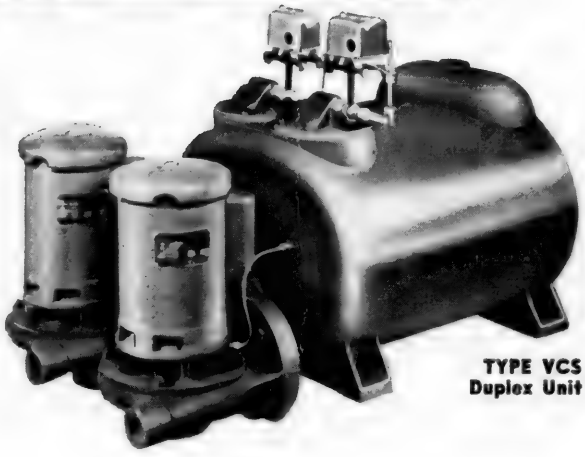
The Economite has a 5-inch diameter tube and is designed throughout for easy installation. It is factory tested on gas and shipped as a package, ready for installation. It is available with either thermoelectric or electronic controls.

More Information? Circle Item 73 on Inquiry Card.

IMPROVED DESIGN!



TYPE VCS
Single Unit



TYPE VCS
Duplex Unit

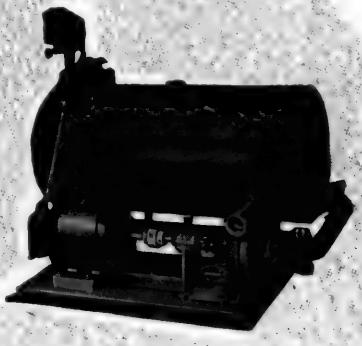
Mechanical Shaft-Seal

close-coupled design

TYPE CCVS
Single Unit

More Capacity!

More Performance!



TYPE HS
No. 14-E

New Bulletins

TYPE VCS—No. 10-C

TYPE CCVS—No. 21-C

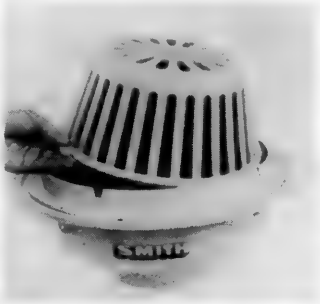
Engineered to meet your exacting requirements. Select from a new wide range of types, sizes, capacities and pressures. Features include: Low inlet connection—simplified construction, easily accessible for inspection — rugged cast iron receiver — bronze fitted throughout. Contact your local Skidmore representative or write direct for bulletins.

Skidmore pumps have set a standard of performance and dependability through continual development since 1921.

SKIDMORE CORPORATION ST. JOSEPH, MICHIGAN

Roof Drain Strainer Dome

An indestructible and maintenance free roof drain strainer dome that weighs less than 1 lb, is available with any of the complete line of 16-inch roof drains manufactured by Jay R. Smith Mfg. Co., Union, N. J.



It is made of a polyolefin resin called Fortiflex, which according to the manufacturer provides greater impact strength, easier installation, durability, and freedom from maintenance cost.

Weighing only 14 oz, the dome is strong enough to support the weight of two men, and will not break if dropped, roughly handled, or struck by any sudden impact. Unaffected by hot tar, weather and temperatures, it is not subject to rusting, or corroding so that it never requires painting or maintenance, and will permanently retain its smooth, attractive appearance. Built-in locking lugs automatically secure the dome tightly to the drain body clamping collar.

More Information? Circle Item 74 on Inquiry Card.

Heavy Duty Automatic Air Filter

A line of Automaze Model HD heavy duty, automatic air filters is introduced by Air-Maze Div. of Rockwell-Standard Corp., Cleveland, Ohio, for use on installations such as air intakes of large gas turbines in stationary power plants and similar applications requiring uninterruped service over long periods with little or no maintenance.

The oil-wetted filters, in rated maximum capacities from 3,720 cfm to 130,500 cfm based on a net effective filter face velocity of 450 fpm, are fully guaranteed against oil carryover. They may also be used at the standard rated velocity of 505 fpm, with maximum rated capacities of 4,166 cfm to $146,160 cfm.

The cabinets range in size from approximately 5 x 5 ft to 27 x 15 ft, with all cabinets nominally 2 ft deep. Powered by a heavy duty polyphase 60 cycle motor driving through a double reduction worm gear reducer, the units may be adjusted to cycle, as required by the application.

Heavy all-weather louvers are hinged to provide easy access to the filter panels. Large foreign objects are barred by a heavy galvanized wire-mesh screen. The single-unit drive powers from one to four sections, by means of a through shaft and self-aligning coupling between the adjoining filter sections. A shear pin protects the drive against sudden overloads.

More Information? Circle Item 76 on Inquiry Card.

Ceiling Air Diffusion System

An air-diffusion system, which improves air-conditioning efficiency and reduces installation costs has been developed for commercial, institutional and industrial buildings by Armstrong Cork Co., Lancaster, Pa.

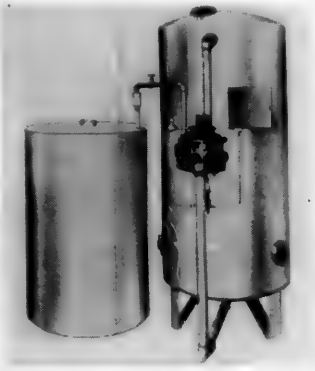
The system employs a type of ventilating acoustical ceiling, which allows conditioned air to flow directly into the room at equal pressure and velocity through thousands of tiny perforations in the ceiling material.

The system offers a number of advantages over conventional air-inlet systems. It saves construction costs by eliminating the need for conventional diffusers that would ordinarily be placed in the ceiling or upper wall. It also eliminates a substantial amount of ductwork. In many cases, a single stub duct is all that is required to deliver the necessary volume of air to the plenum space above the ceiling. The conditioned air disperses throughout this space, builds up a slight pressure, and is pushed down into the room through the ceiling perforations. The ceiling usually requires a shallower plenum space than conventional installations because of the smaller amount of ductwork required.

More Information? Circle Item 75 on Inquiry Card.

Water Softener For Coin Laundries

Universal Water Softener Co., Geneva, Ill., announces the addition of a low-cost high-flow commercial water softener for coin laundries to its line of softeners and filters.



Features include highest quality at a low first cost and low operating cost; heavy-duty steel tanks, hot-dip galvanized both inside and out; automatic bypass of water during regeneration; automatic backwash control that prevents loss of mineral; four-position multiport valve; adjustable timer clock on all automatic units for different water conditions; and lifetime golden bead high-capacity softening mineral. It is available with manual, semiautomatic, and fully automatic regeneration.

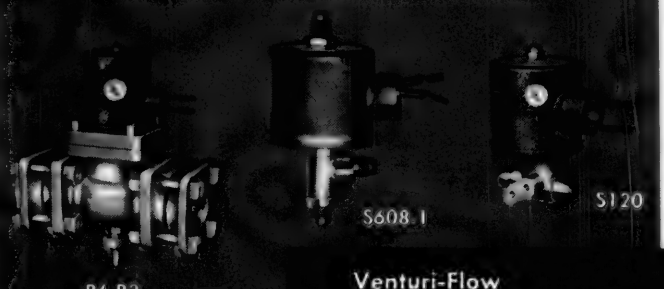
More Information? Circle Item 77 on Inquiry Card.

ALCO *the one complete line of* REFRIGERANT CONTROLS

FOR AIR CONDITIONING AND REFRIGERATION

Thermo® EXPANSION VALVES
for all refrigerants from 1/4 to 200 tons

SOLENOID VALVES
Sizes & Type for every application and refrigerant



ALCO VALVES • CONTROLS
STRAINERS • DISTRIBUTORS
FOR EVERY APPLICATION—DIRECT EXPANSION OR FLOODED SYSTEMS

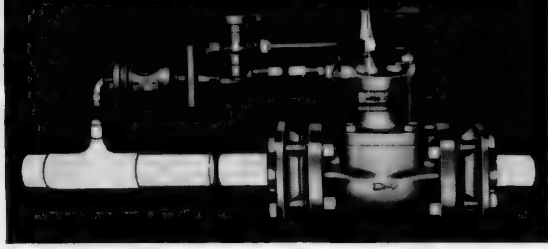
REFRIGERANT STRAINERS
maximum Screen area—
Sizes & Type for every application

Venturi-Flow DISTRIBUTORS

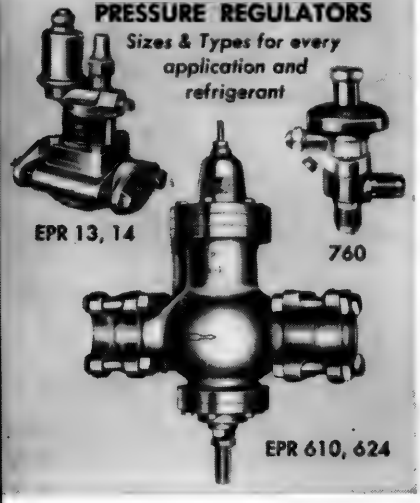
wide application . . low pressure drop . . any position . . . one-piece construction . . . no nozzles

Float SWITCHES
for trouble-free liquid level control

P.O.S. PILOT OPERATED THERMO® VALVE
with integral solenoid stop . . . for larger installations



EVAPORATOR PRESSURE REGULATORS
Sizes & Types for every application and refrigerant



REFRIGERANT FILTER-DRIER
97% pure Dessicant
Block Form
Silica-Gel PA 400
and Molecular Sieve

ADK

Use and Specify ALCO Controls *the one complete line designed and engineered for efficient trouble free performance.*

See your Alco Wholesaler—Write for Specification Details

ALCO VALVE CO. 859 Kingsland Ave. • St. Louis 30, Mo.

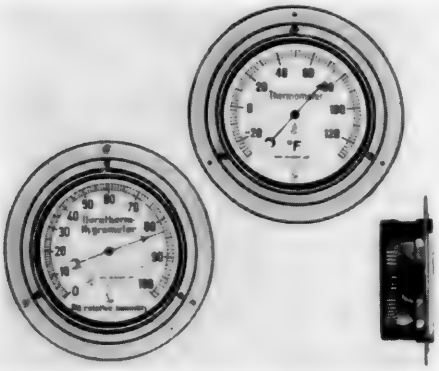
BUY SECURITY • BUY QUALITY • BUY ALCO

The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors • Solenoid Valves Refrigerant Filter-Driers • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

8217-2

Humidity, Temperature Indicators

Abrax Instrument Corp., Jamaica, N. Y., announces two flush mounted instruments for accurate measurement of temperature and humidity. The Durotherm hygrometer, Model No. AB2T, and the thermometer, Model No. TAB3T, are designed for mounting flush with a wall or cabinet. The humidity and temperature measuring elements project through the cabinet or room wall to a depth of 1-inch and measure the humidity and/or temperature of the area on the other side of the wall. They are suitable for installation on the outside of air ducts, drying chambers, incubators, and similar applications.



The hygrometer can be used in temperatures up to 230 deg F and measures relative humidity from 0 to 100%. It has a dial diameter of 5⅛ inches for clear and easy reading and an overall diameter of 7 inches. The casing is all brass. The thermometer measures temperatures minus 30 deg to plus 130 deg. Its dimensions and finish are the same as those of the hygrometer.

More Information? Circle Item 78 on Inquiry Card.

Meter Reads Temperature, Velocity

Direct accurate reading of air velocity and air surface temperature is possible with the Flowtronic 55 introduced by Flow Corp., Cambridge, Mass. Temperature measurement range is 20 deg F to 220 deg, and air velocity ranges are 0-1000 fpm, 1000-2000 fpm, and 2000-4000 fpm.

A rapid response electrical output (d.c. to 1000 cps) suitable for use with a chart recorder is an additional standard feature. The temperature scale is linear over the entire temperature range while the velocity scale is linear at high velocities.

It is useful in mechanical or electrical component cooling problems; air flow, cooling, and distribution studies, and similar applications. Its high sensitivity at low flow rates makes it particularly useful for detecting slow air circulation in enclosed spaces.

More Information? Circle Item 79 on Inquiry Card.

Operating Cost Reduced 30 to 50%

Statham-Swearingen, Inc., Subsidiary of Statham Instruments, Inc., Los Angeles, Calif., announces its 15 ton gas air conditioning unit, Model GA-15, which it claims can air condition a moderate size building at an operating cost saving of 30 to 50 percent over conventional units.

The unit utilizes the principle of producing cold from a gas flame by a new lithium bromide-water absorption cycle based on the two-effect generator principle. The unit receives its energy directly from a gas fired burner using this principle. It produces chilled water for air conditioning and industrial cooling applications. Water is the refrigerant and lithium bromide the absorbent. A motor-driven pump circulates the refrigerant and absorbent solution in the sealed system.

In a two-effect absorption cycle, one Btu is removed for each Btu of heat supplied, which makes cooling as inexpensive as heating, the company states.

More Information? Circle Item 80 on Inquiry Card.

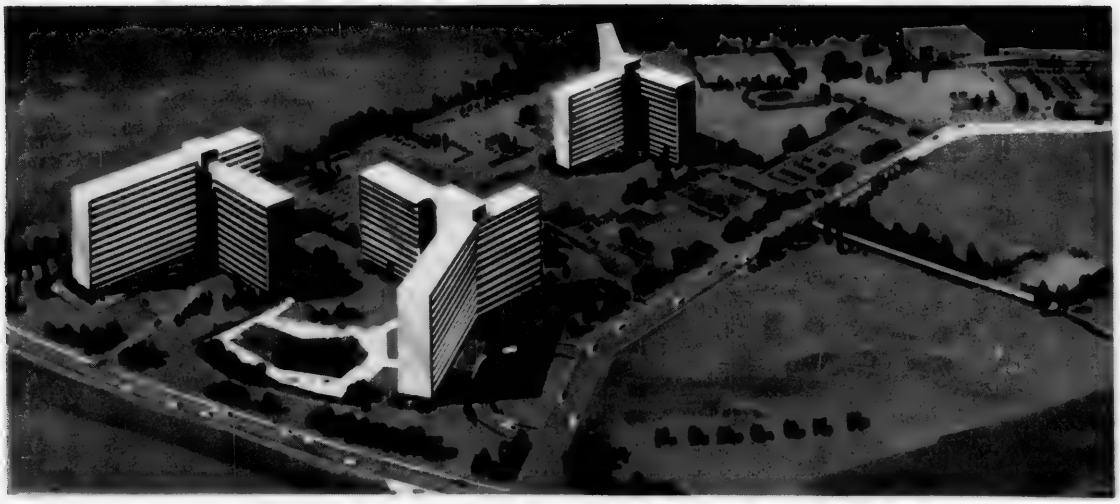
Pipe Repair Clamp

A wrap-around pipe repair clamp featuring bolts on one side and a thick, butt-seal rubber gasket is offered by Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa. To be marketed under the trademark "Dresser 360 All-Around Clamp", the device provides a ⅜-inch adjustment on diameter so that a single clamp will fit a large number of pipe diameters.

Designed for the repair of holes, circumferential breaks, or splits in industrial, slurry, process, or water piping, the adaptability of the clamp permits its use on both the rough barrel or machined ends of asbestos-cement pipe, and on the run of cast-iron and steel pipe. In addition, it may be used where pipe ends are deflected up to 4° or offset ⅛-inch. A sectional lug and the gasket design allow use of the clamp to join pipes of up to ¼ inch difference in outside diameter. A thick spanner plate supports the gasket so that pipes may be connected with as much as a one-inch gap between pipe ends.

The Style 360 is available in nominal sizes from 2 inches to 12 inches, fitting pipes with outside diameters from 2.38 inches to 14.50 inches. Clamp widths vary from 6 inches to 30 inches.

More Information? Circle Item 81 on Inquiry Card.



Cooper River Plaza Apartments Pennsauken, N.J. (one unit completed) *Architect:* John Hans Graham & Associates, *Mechanical Contractor:* Daniel J. Keating Company, *General Contractor:* Oakwood Building Corp.

Dormitories, University of Delaware, Wilmington, Del. *Architect:* Howell Lewis Shay, *Mechanical Contractor:* Daniel J. Keating Company, *General Contractor:* Frank H. Wilson Co.

Prefabrication with Anaconda Copper Tube, on the site or at the shop . . .

. . . results in a faster, more compact and economical job.

Prefabrication with Copper

"a more compact and economical job"

"We like to work with copper because it not only gives our customers a top-quality job, but also because of the ease of installation it affords our men in the field. Its light weight and time-saving prefabrication possibilities afford the contractor the means to install a more compact and economical job. In brief, copper piping serves the owner and contractor best." So says Mr. D. J. Keating, Jr., President of the company which installed Anaconda copper tube for water lines and sanitary drainage in these projects.

For complete information about Copper Tube and Fittings, write Anaconda American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

61-977

ANACONDA

AMERICAN BRASS COMPANY

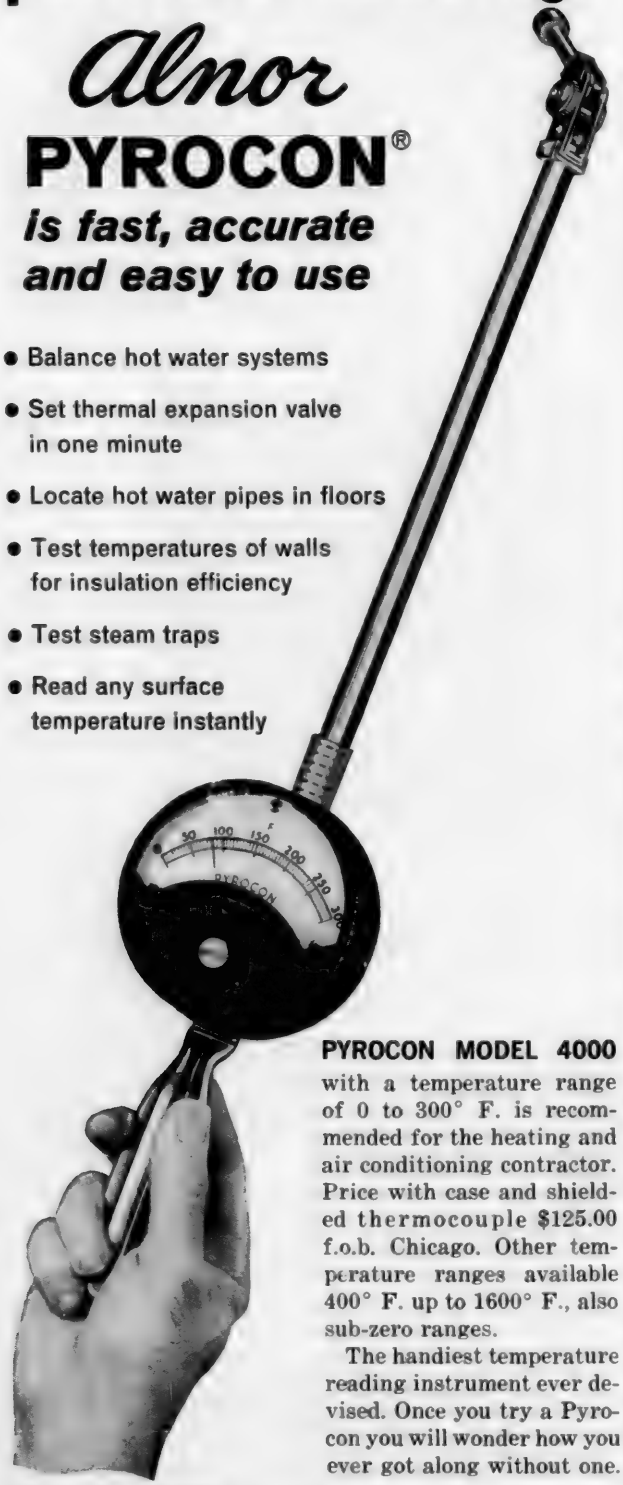
For Surface Temperature Readings

Alnor

PYROCON®

is fast, accurate and easy to use

- Balance hot water systems
- Set thermal expansion valve in one minute
- Locate hot water pipes in floors
- Test temperatures of walls for insulation efficiency
- Test steam traps
- Read any surface temperature instantly



PYROCON MODEL 4000 with a temperature range of 0 to 300° F. is recommended for the heating and air conditioning contractor. Price with case and shielded thermocouple $125.00 f.o.b. Chicago. Other temperature ranges available 400° F. up to 1600° F., also sub-zero ranges.

The handiest temperature reading instrument ever devised. Once you try a Pyrocon you will wonder how you ever got along without one.

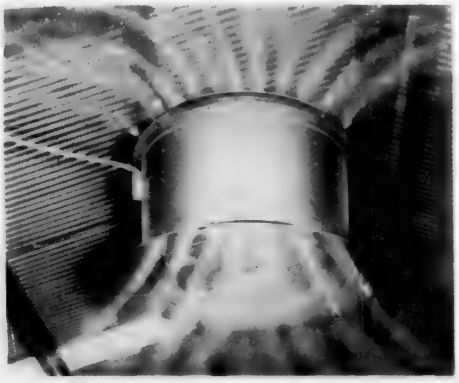
Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.
Division of
Illinois Testing Laboratories, Inc.
Room 570, 420 N. LaSalle St., Chicago 10, Ill.

Heat Recirculator Reduces Costs

Genie-Air, Los Angeles, Calif., manufacturers of industrial powered ventilators, announces production of a heat recirculator, Model HR.

Heat normally trapped under the roof line is recovered and returned to the floor area. The motor-operated fan pulls heat into top of unit and diffuses it down through conical openings, obtaining maximum floor coverage.



No holes are required in roof; installation is simple; and it is applicable to new and old construction. Available in sizes 280 to 30,000 cfm. Summer exhaust may be increased by suspending it under existing gravity ventilators and reversing rotation of motor through a selective control switch.

More Information? Circle Item 82 on Inquiry Card.

Electrically Operated Ball Valves

McCannaseal top-entry ball valves, a product of Hills-McCanna Co., Carpentersville, Ill., are available with electric operators for automatic and remote on-off flow control applications. Operators are sold integrally with the valves or separately for bolting directly to the bonnet of any valve already in service.

Features of the operators include: Weatherproof and explosionproof construction; stainless steel output shaft; aluminum housing; and hardened steel gear train. Cycle time to fully open or fully close the valves is 5 to 12 seconds, depending on valve size; 115v a-c is standard. Other a-c or d-c voltages are available.

The electrically operated valves are available in 1 to 8-inch sizes for pressures to 720 psig and temperatures to 1000 deg F, depending on pressure and service conditions. Ductile iron, carbon steel, stainless, bronze, and aluminum bodies with screwed, socket end, or flanged ends are standard. Seats are Teflon or reinforced Teflon in standard or fire-seal design. Graphitar seats also are available for high-temperature service.

More Information? Circle Item 83 on Inquiry Card.

Fiberglas Duct System

A duct system which combines air duct, thermal insulation, acoustical liner and a vapor barrier in one product for residential and commercial heating and air conditioning is announced by Owens-Corning Fiberglas Corp., New York, N. Y.

The result of several years of research and field testing, the system can be installed faster than conventionally insulated or lined sheet metal ducts the company claims. It is available in rectangular and round forms as well as flat boards, which can be fabricated into duct components.

The duct consists of high density Fiberglas thermal and acoustical insulation with a flame retardant, puncture-resistant vapor barrier jacket. On the residential line the vapor barrier jacket is a special laminate of embossed kraft paper and aluminum foil reinforced with Fiberglas yarns; the commercial line utilizes a similar laminate with an easily cleaned vinyl surface.

Circle Item 86 on Inquiry Card.

Filter Protects Shelter Air Intake

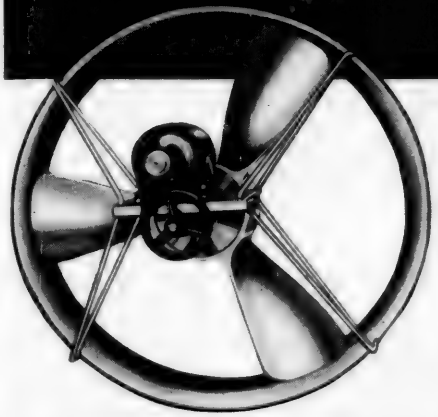
Purolator Products, Inc., Rahway, N. J., has developed a dry type air filter which prevents radioactive contamination of air intake systems on fallout shelters.

The filter, a variation of the company's automotive air filter, provides filtration of particles as small as five microns.

According to the company, the filter is necessary on large family-size fallout shelters equipped with air intake systems which may draw fallout particles into the shelter. For small shelters where air is not being pumped in, a hooded air intake pipe or elbow-type pipe is sufficient.

It consists of a dry resin-impregnated "paper-like" filtering element housed in a steel case or cover, mounted on a 3-inch threaded pipe. The filter is installed atop the pipe by threading it into a 3-inch coupling.

Circle Item 87 on Inquiry Card.



Special air-foil blade which is designed to operate efficiently at slow speeds reduces noise intensity by as much as 30% below that of conventional propeller fans. Exclusive Hartzell curved orifice air seal ring further increases efficiency and reduces noise by eliminating turbulence and backflow of air at the propeller tips. Seven sizes, 24" to 60". Cast aluminum alloy propellers, ring or panel mounting.

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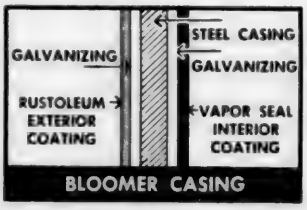
QUALITY . . . at a competitive PRICE

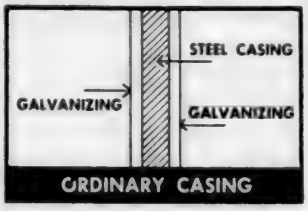
5 thru 550 Tons in a Single Cell



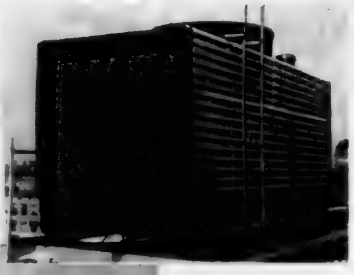
All models thru 200 tons can be shipped factory-assembled for job-site delivery by truck.

All models available knocked-down for easy field erection.

Experienced engineering assistance available.



Single Flow Models 5 thru 80 Tons



Dual Flow Models 80 thru 550 Tons

FISKE COMPANY
1231 W. 47th St. Chicago 9, Ill.
Send FREE catalog on BLOOMER COOLING TOWERS

Company_____

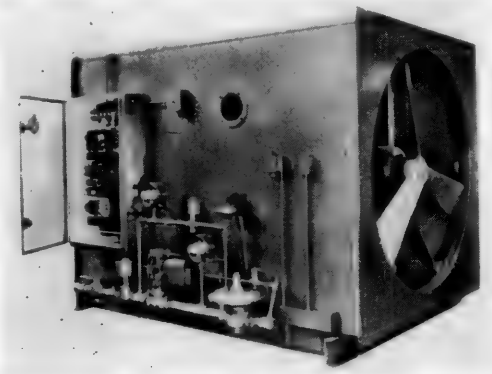
Individual_____

Address_____

Gas-Fired Make-Up Air Units

To eliminate the problems of unbalanced ventilating systems and negative building pressures encountered by industry in winter, the Propellair Div., Robbins & Myers, Inc., Springfield, Ohio, has designed a self-contained, gas-fired make-up air unit for introducing comfort-tempered air into working areas.

Three basic sizes, providing a total of six ratings, are available. Air deliveries range from 22,000 to 70,000 cfm; Btu ratings from 2,125,000 to 5,375,000 are offered. Other sizes and ratings may be obtained for special applications. All units incorporate a burner design which delivers 100% of available heat in the gas into the airstream, the company states.



Modulating controls provide 25:1 turn-down ratio, permitting effective performance under all outdoor temperature conditions. Summer-winter controls enable the units to be used for hot weather breeze cooling. Accessories available include motor operated dampers, filter cabinets, weather hoods, weatherproofed control cabinets, duct turning elbows, and remote control.

More Information? Circle Item 84 on Inquiry Card.

Jet Burner Capacity Increased

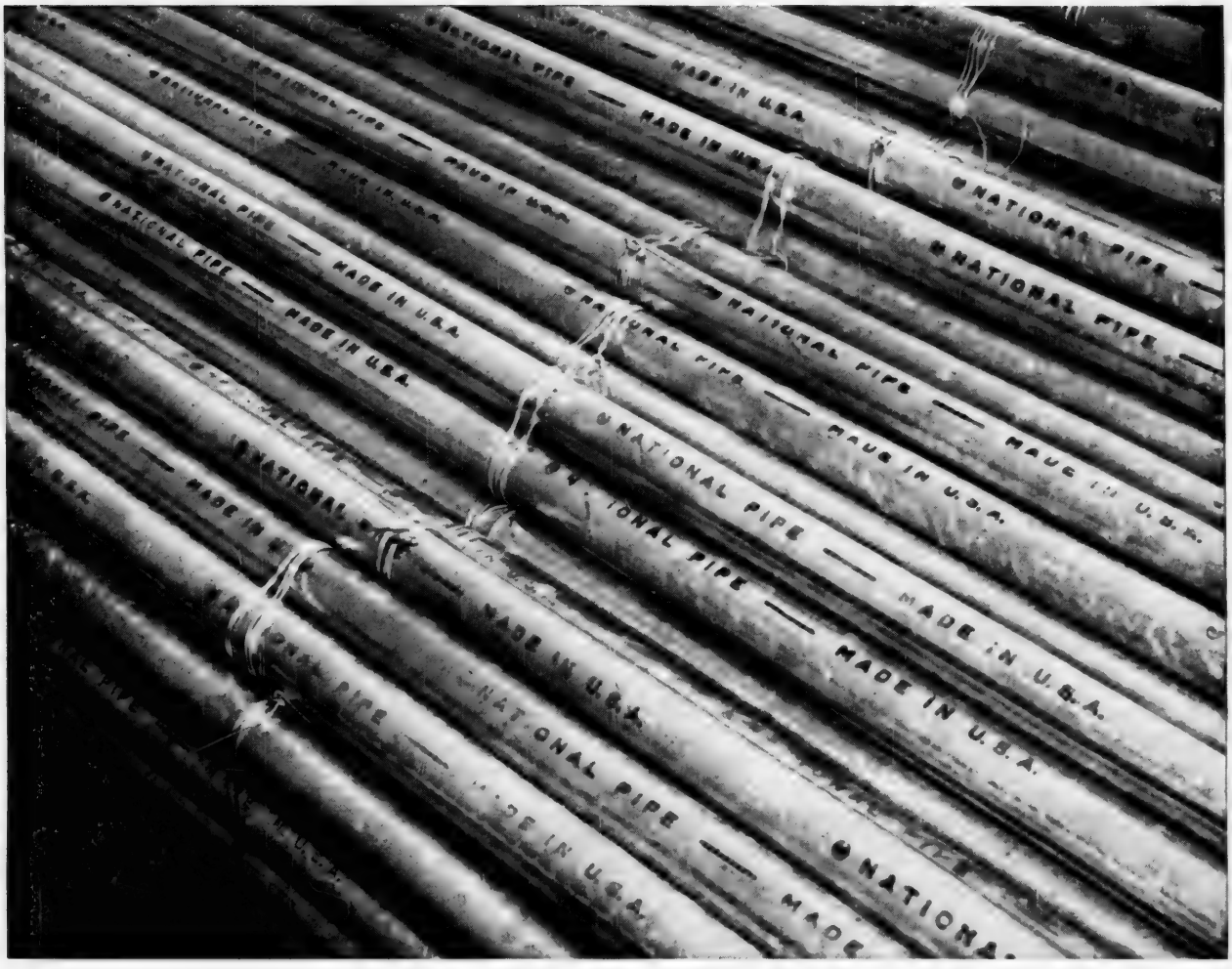
The Barber Mfg. Co., Cleveland, Ohio, has increased the capacity of its impinged jet burners to range from 400,000 to 3,200,000 Btu per hr.

The burners can be turned down as low as 0.1 inches water pressure and still burn with an efficient and stable flame with no flash back. Because each burner assembly is designed to fit a specific boiler, an even distribution of intense heat throughout the entire heating surfaces of the boiler is provided, eliminating danger of hot and cold spots, the firm states.

Each burner is assembled at the factory to fit the specific fire box at grate level. Primary air adjustments are not necessary since each jet is drilled at the factory to the proper gas-air proportions according to the gas specified.

More Information? Circle Item 85 on Inquiry Card.

This mark tells you a product is made of modern, dependable Steel.



Be sure the pipe you buy is marked "USS National Pipe... Made in U.S.A."

Take a good look at the next pipe you buy. Do you know who made it? How it was made? Its quality? If your pipe is marked "USS National Pipe—Made in U.S.A.," you can be sure you're getting high-quality steel pipe made on the most modern facilities by the largest pipe producer in the world. (National Tube led the way with its pipe-marking program.)

Order USS National Pipe from your local National Tube Distributor. You get fast delivery of the finest product from a man you can trust—a tough combination to beat!

USS and National are registered trademarks

National Tube Division of United States Steel

Columbia-Geneva Steel Division,
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BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

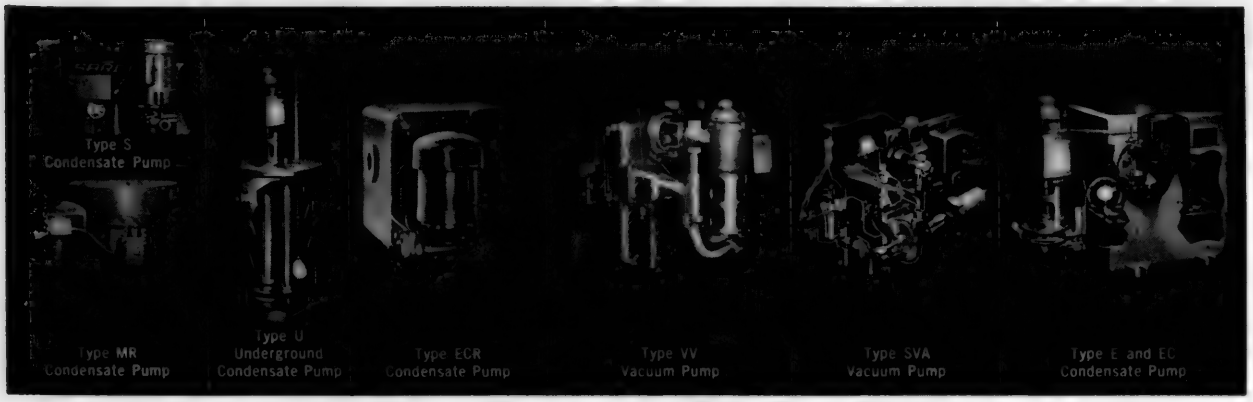
QUESTIONS AND ANSWERS — *Standard Refrigeration and Air Conditioning Questions and Answers* provides a quick, practical introduction to the principles and applications of refrigeration and air conditioning in a variety of industries. Using the question-and-answer form of presentation, the book is directed at operating and servicing personnel in all phases of the refrigeration and air conditioning industry, as well as trade, vocational schools and technical institute students. The questions and answers presented not only give a basic understanding of the subject, they also help the reader prepare for the city, state, or Federal refrigeration license examination, as well as civil-service positions.

The authors, Stephen M. Elonka and Quaid W. Minich, believe that it is not enough to know how to operate today's automatic equipment. The operator must have some knowledge of the basics and theory of refrigeration and air conditioning. To this end, they place special emphasis on fundamental principles and items of equipment. There are chapters on refrigeration systems, refrigerants, compressors, condensers, evaporators, refrigerant controls, electric controls, piping and fittings, lubrication and seals, defrosting, compressor and motor drives, calculations and definitions, operation, servicing, and trouble-shooting. There is also material on cooling towers, cooling water and brines, safety, and cryogenics.

The book, containing 253 pages with 147 illustrations, sells for $6.95 and is published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.

PRIMER FOR PARENTS — *Is There a Future Scientist or Engineer in Your Home?* is the title of a booklet published by Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio. Offered as a primer to help parents and leaders of young people in the discovery and encouragement of the nation's future scientists and engineers, the booklet outlines characteristics which may indicate an embryo engineer or scientist. It also emphasizes that, if he or she is not discovered early enough and encouraged to complete required courses in high school, the chances are he will find it difficult to succeed at the university of his choice. The booklet lists the subjects and courses which are "musts" in high school. In addition, it suggests other academic and associated activities which help to develop the embryo engineer or scientist. Single copies are free.

(Continued on page 120)



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SARCO CONDENSATE PUMPS discharge to boilers fast . . . give quiet, dependable operation . . . are constructed of finest materials . . . engineered for quick, easy installation to meet a variety of conditions . . . have steel or cast iron receivers and close coupled or flexible coupled motors.

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Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

✶ **ALUMINUM** construction...rust-proof...corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.

✶ **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.

✶ **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).

✶ **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.

✶ **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters —with no increase in resistance—at *no* extra cost!

✶ **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.

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(Continued from page 118)

AIR CONDITIONING FUNDAMENTALS—A textbook on air conditioning designed primarily for use in vocational schools and technical colleges has recently been written by Paul Lang, technical editor in the application engineering department of Carrier Air Conditioning Company. Entitled *Principles of Air Conditioning*, and published by Delmar Publishers, Inc., Mountain View Ave., Albany, N. Y., the book describes in simple terms the "how to" and "why do" of technical air conditioning problems encountered by technicians and servicemen. Included in the 327 pages are more than 500 illustrations and tables related to air conditioning equipment. Price is $6.25.

Questions and problems at the end of each chapter highlight the important facts presented in that chapter. Subjects discussed include basic psychrometrics, load estimating, duct design, installation data and controls. Helpful study aids such as psychrometric charts, load estimating forms and a house plan are provided in the back cover.

A separate pamphlet containing answers to problems in the textbook and a laboratory guide manual are available to instructors in vocational schools and junior colleges.

ASHRAE GUIDE—Its 1961 *Guide and Data Book* is available from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 345 East 47th St., New York 17, N. Y. Price is $12.50. It is a consolidation and revision of predecessors HVAC *Guide* and ASRE *Data Book*. The 1961 volume of one of two that appear every other year. It is devoted to fundamentals and equipment, containing sections on theory, materials, load calculations, system components, unitary refrigeration equipment, air conditioning units and refrigerant systems. There is a complete index for the 67 chapters plus 406 pages of product specifications.

AUTOMATIC CONTROL — The second edition of John E. Haines' *Automatic Control of Heating and Air Conditioning* is available from McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. Priced at $10.50, it is devoted to fundamentals, selection, and application. The second edition contains four new chapters: "Electronic Control Circuits," "Electronic Control Units," "Control of Domestic Air Conditioning," and "Control of Peripheral Distribution Units." Mr. Haines is a vice-president of Minneapolis-Honeywell and past-president and fellow of ASHRAE.

(Concluded on page 122)

DESIGNED FOR ARCHITECTS • ENGINEERS • CONTRACTORS

Whatever the architectural specifications, the slim-trim distinctive design of Stripline extruded aluminum slot-type diffusers blends in perfectly with the general decor. Stripline with separate plaster frames and removable cores eliminates screwholes, leaves the decorative surface unmarred. Installation is simple... no tools required.

Stripline is INCONSPICUOUS... PRACTICAL, can be located anywhere to suit the interior designer's preference... in walls... ceilings... coves... moulds... window sills. Stripline is supplied as a continuous decorative unit, or in sections, to meet any requirements of interior treatment or airflow.

Unlike side wall grilles and air discharge slots, Stripline diffusers incorporate the exclusive Agitair diffusing vanes. These built-in diffusing vanes produce extremely high turbulence and aspiration... achieve rapid temperature equalization... insure the distribution of tempered air unvaried over a predetermined area without any noticeable air motion.

For more information write for technical catalog ES-105

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When buying ART...

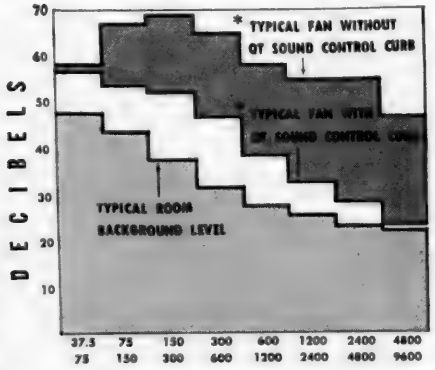
or selecting a SOUND CONTROL CURB it pays to be SURE!

1. **Be sure that performance data has been authenticated**
2. **Be sure that the design is original and not bootlegged**
3. **Be sure that you are not accepting a hastily copied, low quality substitute**
4. **Be sure that rights to produce and use are clearly established by patent and copyright laws**

The famous admonition, *caveat emptor* ("let the buyer beware"), is well worth calling to mind when it comes to selecting a sound attenuating curb for your power exhausters. Since performance cannot be judged visually, extreme caution is your best insurance against disappointing results.

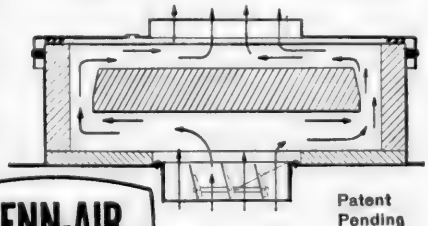
Consider these facts: Jenn-Air's QT Sound Control Curb is the first curb that *effectively* reduces fan noise. This major breakthrough in design provides twice as much attenuation as any previous so-called sound curb. The QT Sound Control Curb reduces exhauster sound power at inlet by 90%...with only a 10% drop in air moving capacity! These are actual performance figures—verified by independent laboratory tests.

Get all the facts before you specify—you'll find the Jenn-Air QT Sound Control Curb to be the genuine article. Write for Bulletin 601-SC.



*MODEL 100 CR, ½ HP, 1725 RPM MOTOR

EXCLUSIVE JENN-AIR DESIGN
Cross Section QT Sound Control Curb



Patent Pending

JENN-AIR QT SOUND CONTROL CURB

JENN-AIR PRODUCTS COMPANY, INC. • 1102 STADIUM DRIVE • INDIANAPOLIS 7, INDIANA

(Concluded from page 120)

SEVEN NEW NFPA STANDARDS—Important new fire safety provisions in installations of air conditioning, ventilating and warm air heating systems have been issued by National Fire Protection Association. Revisions of two widely recognized NFPA standards were adopted at the organization's 1961 annual meeting.

Among the changes in NFPA No. 90A, which covers installations of non-residence type air conditioning and ventilating systems, are stiffer requirements for combustibility of linings, coverings and insulations, and also a requirement for a damper in ducts piercing enclosures for vertical openings.

NFPA No. 90B, which deals with residential type warm air heating and air conditioning systems, has been revised principally to require increased clearance above the bonnet or plenum chamber. It also rules out use of evaporative coolers containing combustible filters and water evaporation mediums like excelsior.

A revised edition of the NFPA standard on water cooling towers *NFPA No. 214*, has just been released by the National Fire Protection Association.

Adopted at the international fire safety organization's recent annual meeting, the revision calls for screening around the bases of towers to deal with the problem of combustible waste accumulations and to prevent the hazardous practice of using this space for storage of combustibles.

The standard, widely used as a guide by building inspectors, plant protection people and constructors of the equipment, covers location and construction of the towers, installation of electrical equipment, and methods of protection.

Copies of the new publications—*NFPA No. 90A* (26 pages, 60 cents a copy), *NFPA No. 90B* (24 pages, 50 cents a copy) and *NFPA No. 214* (11 pages, 50 cents) are available from National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

The following standards are also available from the Association. Standard No. 204, *Guide for Smoke and Heat Venting*, costs 50¢; No. 96, *Ventilation of Restaurant Cooking Equipment*, costs 40¢; No. 97M, *Standard Glossary of Terms Relating to Chimneys, Gas Vents and Heat Producing Appliances*, costs 40¢; and No. 211, *Standard for Chimneys, Flues and Vents*, costs 50¢.

Exhausting/Supplying air has been Western's only business for 40 years. Ask about system engineered quality roof ventilators next time you have an air moving problem. Western's complete line of compact centrifugal, axial, and gravity equipment is engineered to move air efficiently and economically. Complete engineering service and maximum production flexibility enable Western to solve your special ventilation problem. Write for catalog and name of nearest representative.

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MEMBER OF AIR MOVING AND CONDITIONING ASSOCIATION, INC.

MAINTENANCE IS PART OF HEATING PLANT COST

GAS BOILERS
A.G.A gross outputs
to 4,320 MBH

OIL BOILERS
I=B=R gross outputs
to 3,790 MBH

Over the life of a boiler, original and operating cost are only part of the total expense. Maintenance cost also can become a major item.

In Weil-McLain Gas and Oil Boilers are features of design and material which are warranties of minimum maintenance.

These boilers have no tubes which must be periodically replaced...do not require water treatment...and are easily cleaned for retention of full efficiency.

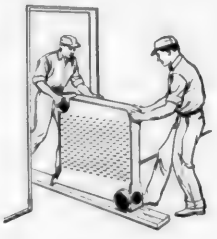
From the stand-point of repairs, maintenance expense is minor. Weil-McLain Boilers are built of *cast iron*...strongly resistant to corrosion...immune to usual causes of boiler breakdown. Any possible service work does not require expensive welding and inspection...and an operating engineer is not needed.

A Weil-McLain sectional boiler also provides a hedge against future needs. If additional capacity is required, a second boiler can be installed to supplement the original boiler, or additional sections installed in the present boiler...in either case without need for structural alterations.

BOILERS FOR OTHER FUELS

Weil-McLain Boilers for commercial, industrial and institutional installations are available for gas, oil, heavy oil, combination gas-light oil, or coal. For full information write Weil-McLain Company, Michigan City, Indiana, or see Engineers' Product File or Sweet's Architectural File.

The sections of any Weil-McLain Gas or Oil Boiler, regardless of capacity, can be moved through an ordinary doorway.



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"BOILERS WITH A FUTURE"

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TITLE: "Pure and Simple."
THEME: Practical solutions to problems of industrial waste and water conservation are detailed in this 19-min motion picture. It is aimed at groups concerned with industrial waste problems.
CONTACT: Public Relations Dept., Link-Belt Co., Prudential Plaza, Chicago 1, Ill.

* * *

TITLE: "Semi-Rigid Plastic Pipe."
THEME: 20-min 16mm color-sound film covers ABS semi-rigid plastic pipe. Urban and rural water systems, gas utilities, and manufacturers of mobile homes are gaining superior piping performance while cutting purchase and installation costs.
CONTACT: Film Dept. C-2, Marbon Chemical Div., Borg-Warner Corp., Washington, W. Va.

* * *

TITLE: "Off the Floor Fixtures."
THEME: 28-min full-color sound slide film shows the developments in off the floor fixtures, the advantages, and methods of installation. A cartoon character named "Unitron" serves as guide through the film.
CONTACT: Josam Manufacturing Co., Michigan City, Ind.

TITLE: "What Kind of Pipe Should I Buy?"
THEME: 14-min 16mm sound-color film answers the common questions raised by persons interested in polyethylene for cold water piping. It deals with such subjects as density, standards, tests, comparative costs and safe materials in understandable, non-technical terms.
CONTACT: Plastics Div., Allied Chemical Corp., 40 Rector St., New York 6, N.Y.

* * *

TITLE: "The Constant Search."
THEME: 20-min 16mm sound-color film tells the story of the first use of a jet-powered gas turbine for stationary power in a natural gas compressor station at Possum Trot, Ky.
CONTACT: Public Relations Dept., The Columbia Gas System, Inc., 120 E. 41st St., New York 17, N.Y.

* * *

TITLE: "Pyrex Brand Double-Tough Drainline."
"How to Cut and Bead Pyrex Brand Pipe."
THEME: "First film, 20-min 16mm sound and color, explains why this glass drainline is effective in the disposal of corrosive wastes and how it is installed. Second film, 16mm sound-color, demonstrates a cutting and beading operation. Ten minutes running length is actual time required for this operation.
CONTACT: Advertising and Sales Promotion Dept., Corning Glass Works, Corning, N.Y.

CHECK THESE FEATURES

- ✓ Stops pulsating and chattering
- ✓ Increases heating efficiency and ouptut
- ✓ One unit handles furnace or boiler, incinerator and hot water heater on single chimney
- ✓ Keeps furnaces, boilers and chimneys free of soot
- ✓ Stops blow-back of poisonous fumes
- ✓ Ideal for homes with outside chimneys
- ✓ Fireplace units with special fittings for direct installation into chimneys with single or two-speed motors available

Will operate with temperatures up to 1700 degrees

A COMPLETE LINE OF RESIDENTIAL AND LIGHT CONSTRUCTION MODELS

SIZES AVAILABLE
4 INCH
5 INCH
6 INCH
7 INCH

SIZES AVAILABLE
8 INCH
9 INCH
10 INCH

12 INCH

Patents
U. S. 2,722,872 and 2,866,574
British 802,920
Canadian 598,817
Other patents pending

10175-QD

WRITE FOR NEW LOW PRICES ON ALL THESE MODELS

HEAVY-DUTY INDUSTRIAL UNITS AVAILABLE
12" 14" 16" 18" 20" 22" 24" 30"
Larger sizes can be made to order

For corrosive service all Quickdraft units are available in standard acid-resisting vitreous enamel, 316 stainless steel, rigid plastics (P.V.C) and with plastic or Fiberglas coatings.

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Newest, Most Dramatic Example is the World-headquarters of

THE CHASE MANHATTAN BANK

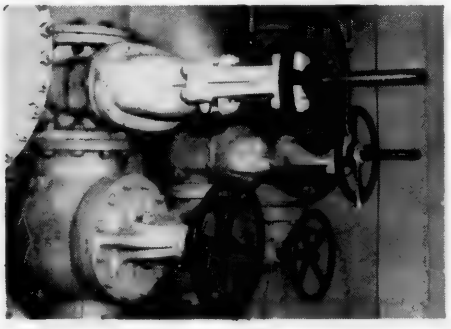
Biggest commercial office building in 25 years... biggest self-contained banking edifice in the world... 60 stories high ... 2,250,000 square feet...

You could fill this magazine with superlatives about The Chase Manhattan's architectural triumph now standing proudly in the Free World's financial heartland on lower Manhattan Island.

But you'd miss one essential superlative if you failed to mention the thousands upon thousands of Jenkins Valves installed throughout the heating and air conditioning systems — even for snow-melting!

For a bank, or for you, there's no sounder investment than Jenkins Valves. Good for a building-lifetime of service, paying day-to-day dividends in savings on maintenance.

Known everywhere as the "standard of quality," Jenkins Valves *cost no more*. That simple fact appeals to bankers, their architects, engineers and contractors. And *you* — did you realize that you can specify Jenkins without paying a penny more than you'd pay for any lesser brand name on good valves? Jenkins Bros., 100 Park Avenue, New York 17, New York.



Architect: SKIDMORE, OWINGS & MERRILL; *General Contractor:* TURNER CONSTRUCTION CO.; *Consulting Engineer:* JAROS BAUM & BOLLES; *Heating & Air Conditioning Contractor:* RAISLER CORP.-KERBY SAUNDERS, INC., all of New York

JENKINS
MOST TRUSTED TRADEMARK IN THE VALVE WORLD
VALVES
JENKINS SINCE 1864
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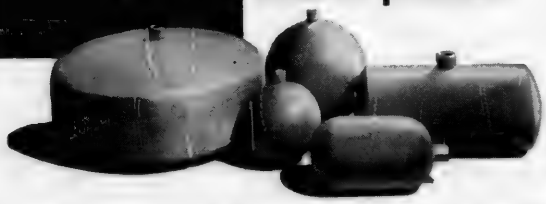
AVAILABLE FROM LEADING DISTRIBUTORS EVERYWHERE

HARRIS FLOATS

for any liquid level control problem



Over 50 years experience in the design and manufacture of floats for liquid level control is at your disposal when you consult Harris on your requirements. Whether your requirements are for high temperature—high pressure service, or should you be handling corrosive liquids, Harris can help you in the selection of the proper float for long, trouble-free service.

Harris manufactures industrial floats of Stainless Steel, Copper, Copper - Plated Steel, Aluminum, Nickel, Monel, etc. of a variety of shapes and sizes depending on the needs of the installation.

Consult Harris on your float requirements for top quality and service.

Write for Harris Float Catalog with its helpful technical data.

HARRIS FLOATS

ARTHUR HARRIS & CO.
Established 1884

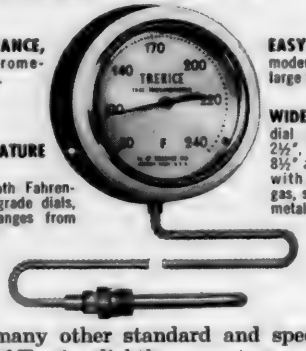
206 No. Aberdeen St.
Chicago 7, Illinois

Dependable Accuracy . . .
with TRERICE
DIAL THERMOMETERS

If you are after precise, dependable temperature indication, take a close look at these high-quality features of Trerice dial thermometers!

HEAT APPEARANCE, distinctive chrome-plated dial ring.

WIDE TEMPERATURE RANGES, available in both Fahrenheit and Centigrade dials, temperature ranges from -100° to 1000° F.



EASY TO READ, modern aluminum dial, large figures.

WIDE VARIETY, dial available in 2", 2½", 3½", 4½", 6", 8½" and 12" diameters with mercury, vapor, gas, solid liquid or bi-metal actuation.

All the many other standard and special option features of Trerice dial thermometers are contained in Bulletin No. 500-M. Write for your copy.

Send Bulletin 500-M.

Name.....

Address.....

City..... Zone..... State.....

H. O. TRERICE CO. 1420-A W. Lafayette Blvd. Detroit 16, Michigan

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

BHC COUNCIL MEETING — Sixth annual meeting of the national Better Heating-Cooling Council will be held at the Hotel Delmonico, New York City, N. Y. For information write Ray Schumack, 250 Park Ave., New York 17, N. Y. ..... **DECEMBER 18-19, 1961.**

CONVENTION AND EXPOSITION—The National Swimming Pool Institute will hold its fifth convention and exposition at Las Vegas, Nevada. For information write to Robert S. Greene, Executive Secretary, Harvard Illinois. ..... **JANUARY 20-26, 1962.**

ENGINEERING & MAINTENANCE SHOW—National Plant Engineering & Maintenance Show, Convention Hall, Philadelphia. Clapp & Poliak, Inc., 341 Madison Avenue, New York 7, N. Y. ..... **JANUARY 22-25, 1962.**

ASHRAE MEETING—The American Society of Heating, Refrigerating and Air-Conditioning Engineers will hold their semi-annual meeting at the Chase-Park Plaza Hotel, St. Louis, Mo. For information write: American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., 345 E. 47th St., New York 17, N. Y. ..... **JANUARY 28-31, 1962.**

ARI EXPOSITION—Air Conditioning and Refrigeration Institute 12th Exposition. Pan-Pacific Auditorium, Los Angeles. Information: George E. Mills, ARI Show Director, 1346 Connecticut Ave. N.W., Washington 6, D. C. ..... **FEBRUARY 12-15, 1962.**

ELECTRIC HEATING SHOW—The Second National Electric House Heating Symposium and Exposition, sponsored by Electric House Heating Section, National Electrical Manufacturers Association. 155 East 44th Street, New York 17, N. Y., to be held at the Sherman Hotel, Chicago, Ill. Write Russell Gingles, NEMA director of public relations. ..... **MARCH 19-21, 1962.**

INDUSTRIAL VENTILATION—Fourth Annual Industrial Ventilation Conference will be held at the North Carolina State College of Agriculture and Engineering. Edward W. Ruggles, Director, Division of College Extension, Box 5125, Raleigh, North Carolina. ..... **MARCH 19-22, 1962.**

NACE ANNUAL CONFERENCE—18th Annual Conference and 1962 Corrosion Show of the National Assoc. of Corrosion Engineers, 1061 M & M Building, Houston 2, Texas, to be held in Kansas City Auditorium with the Muehlebach Hotel as headquarters. T. J. Hull, Executive Secretary. Overall charge of both the conference and corrosion show L. W. Gleekman, Wyandotte Chemical Corp., Wyandotte, Michigan. ..... **MARCH 19-23, 1962.**

OIL HEAT AND AIR CONDITIONING—24th Oil Heat and Air Conditioning Exposition sponsored by National Oil Fuel Institute, Conrad Hilton Exhibit Hall, Chicago. The 40th annual oil heat industry convention will run concurrently with the Exposition. Ralph T. Hartell, National Oil Fuel Institute, Inc., 60 East 42nd Street, New York 17, N. Y. ..... **APRIL 9-12, 1962.**

WELDING CONVENTION AND EXPOSITION—43rd Annual Convention and Welding Exposition of the American Welding Society in Cleveland, Ohio. Technical meeting will be held in the Sheraton Cleveland Hotel and the Welding Show in the Cleveland Public Auditorium. Information Center, American Welding Society, 345 East 47th Street, New York 17, N. Y. ..... **APRIL 9-13, 1962.**

ENGINEERING EXPOSITION CONFERENCE — The Western Space Age Industries and Engineering Exposition will hold their conference in the Cow Palace, San Francisco. Lykke-Wilkin & Associates, 681 Market St. Room 759, San Francisco 5, California. ..... **APRIL 25-29, 1962.**

(Continued on page 128)

EXTRA THIN and EXTRA QUIET
THE NEW McQUAY
LO-LINE SEASONMAKER

more compact—15% thinner than any other make—for flush or away from wall or curtain wall installation

The new Lo-Line Seasonmaker is the most quiet air conditioning unit available and combines expected McQuay dependability with an exciting new design. The Lo-Line is little —just 12½″ deep and 14½″ high in flush wall model or free standing model that permits drapery behind it and is used with glass wall construction. But it's big in features—permanent split capacitor motor, slide out fan deck assembly, motor disconnect plug, large access doors and piping compartments, 1″ vinyl coated insulation, finished rear panel and air filter removal without front panel removal. Wall to wall cabinet extensions are available for flush wall models. For more information, see your McQuay representative, or write to McQuay, Inc., 1619 Broadway N.E., Minneapolis 13, Minnesota.

McQuay means Quality

4 SIZES
220 cfm • 330 cfm
440 cfm • 640 cfm

7 DECORATOR COLORS

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

Call Us For Air Cleaning Help!

Every building presents a special air cleaning problem. For the best solution — no matter what type of building — get expert help from members of the Air Filter Institute listed below. These companies are dedicated to giving you the assistance you need.

Air Devices, Inc.
185 Madison Avenue
New York 16, New York

Air Filter Corporation
4554 W. Woolworth Avenue
Milwaukee 18, Wisconsin

Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 8, Kentucky

Barnebey-Cheney Company
Cassady at Eighth
Columbus 19, Ohio

Continental Air Filters, Inc.
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Louisville 9, Kentucky

Dollinger Corporation
11 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Fram Aire Company
Division of Fram Corporation
135 Zane Street
Henderson, N. C.

Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

Technical Filter Co.
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

Union Carbide Development Co.
270 Park Ave.
New York 17, N. Y.

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Westinghouse Electric Corporation
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Hyde Park, Boston 36, Massachusetts

Air Filter Institute, Box 85, Station E, Louisville, Kentucky

for your convenience
SPRAY NOZZLES
and all related accessories for
HUMIDIFYING
from a single, dependable source
PRECISION PNEUMATIC ATOMIZING NOZZLES
ACCESSORIES SUCH AS AIR FILTERS, HUMIDISTATS, SOLENOID VALVES, PRESSURE REGULATORS
COMPACT HUMIDIFYING UNITS
For industrial installations of every size Spraying Systems offers all needed equipment . . . everything but the piping, wiring and compressor. Provides high efficiency, dependable system; only two components have moving parts. Engineered for easy installation and simplified maintenance.
WRITE FOR Bulletin 82 . . . spray nozzles, assemblies and parts for manual or automatic humidifying systems.
ALSO SUPPLIED . . . spray nozzles for evaporative condensers, air washers, cooling towers, spray ponds and roof cooling systems.
SPRAYING SYSTEMS CO.
3261 RANDOLPH STREET • BELLWOOD, ILLINOIS
ADVANCED SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE

Coming Events *(Continued from page 126)*

SGA-AGA SPRING MEETINGS—54th Annual Convention of the Southern Gas Association combined with the American Gas Association Spring Transmission Conference, Houston, Southern Gas Association, 1524 Life Building, Dallas 2, Texas. . . . . **APRIL 30-MAY 1-2, 1962.**

MCA MEETING—The 73rd Annual Meeting of the Mechanical Contractors Association of America, will be held at the Sheraton Hotel, Philadelphia, Pa. For information write MCA of America Inc., 45 Rockefeller Plaza, New York 20, N. Y. . . **MAY 8-11, 1962.**

AMERICAN INDUSTRIAL HYGIENE CONFERENCE—Exhibits and Conference under the joint sponsorship of the American Industrial Association and the American Conference of Governmental Industrial Hygienists, will be held at the Sheraton Park Hotel, Washington, D. C. William S. Johnson, Medical Div. Bethlehem Steel Co., Bethlehem, Pa. . . . . **MAY 13-17, 1962.**

IBR MEETING—The 47th Annual Meeting of the Institute of Boiler and Radiator Manufacturers will be held at the Seaview Country Club, Absecon, N. J. Information: Institute of Boiler and Radiator Manufacturers, Room 408, 608 Fifth Ave., New York 20, N. Y. . . . . **JUNE 4-7, 1962.**

ASHRAE MEETING—The Annual Meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. will be held at the Deauville Hotel, Miami Beach, Fla. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., 345 E. 47th St., New York 17, N. Y. . . . . **JUNE 18-20, 1962.**

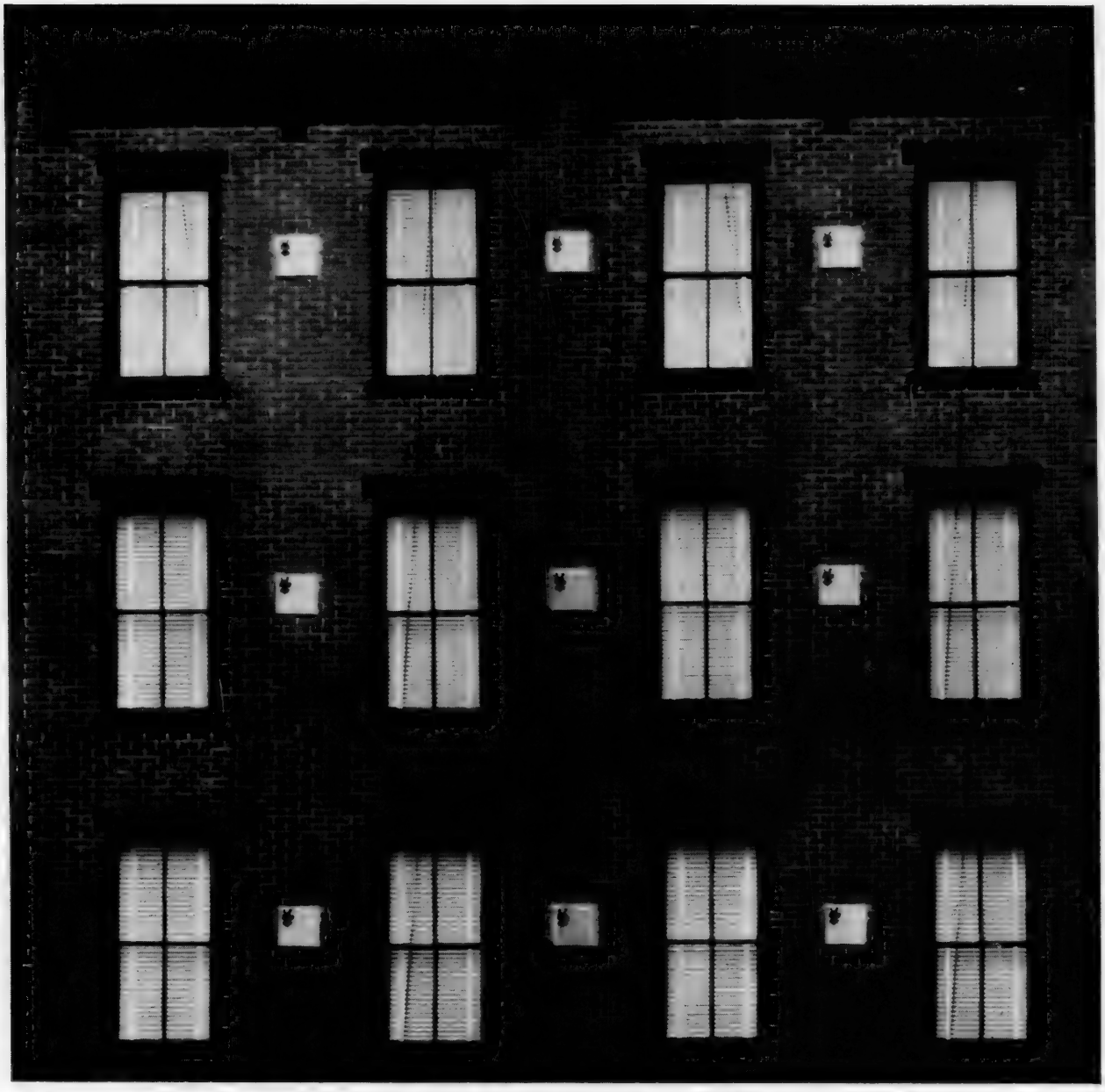
ASTM ANNUAL MEETING—Annual Meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at Statler Hotel, New York City, in conjunction with apparatus exhibit. . . . . **JUNE 24-29, 1962.**

ASSE CONVENTION—Annual convention for the American Society of Sanitary Engineering, will be held at the Hotel Marian, Little Rock, Arkansas. . . . . **OCTOBER 9-14, 1962.**

Canadian Degree-Days for October, 1961*

City	October 1961	October Normal	Cumulative 1961	Cumulative Normal
Calgary, Alta.	774	710	1331	710
Charlottetown, P.E.I.	457	550	592	550
Crescent Valley, B. C.	753	680	1150	680
Edmonton, Alta.	792	750	1310	750
Fort William, Ont.	673	740	1029	740
Grande Prairie, Alta.	855	800	1307	800
Halifax, N. S.	366	469	438	469
London, Ont.	376	490	482	490
Medicine Hat, Alta.	634	600	1084	600
Moncton, N. B.	482	590	617	590
Montreal, P. Q.	425	550	525	550
North Bay, Ont.	576	670	791	670
Ottawa, Ont.	442	580	567	580
Penticton, B. C.	608	520	860	520
Prince George, B. C.	800	750	1395	750
Quebec, P. Q.	566	650	753	650
Regina, Sask.	749	750	1226	750
Saint John, N. B.	501	590	662	590
Saskatoon, Sask.	789	760	1315	760
Timmins, Ont.	721	780	1045	780
Toronto, Ont.	330	465	404	465
Vancouver, B. C.	521	440	767	440
Victoria, B. C.	457	410	708	410
Windsor, Ont.	326	410	409	410
Winnipeg, Man.	650	686	1035	686

* These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.



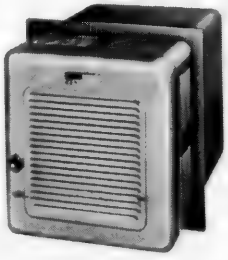
Suburban Novent-Dynavent Gas Heaters solve small space heating problems at lowest cost.

Brooklyn Landlord's problem: He wanted to put a modern heating system into his renovated apartment house, but didn't have a lot of money to do it.

His solution: He installed Suburban Novent* and Dynavent® Gas Heaters.

He got these results: Low, low installation costs . . . because no complicated flue or chimney connections were needed. His tenants really warmed up to the low operating cost of their Suburban Novent and Dynavent Gas heaters . . . and the extra bonus of comfort they got with set-it-and-forget-it, individual temperature controls.

How can you get the advantages of modern, trouble-free gas heat with low-cost Suburban Novent and Dynavent Gas heaters? Call your local Gas Company, or write Suburban Appliance Co., Morristown, N. J.



American Gas Association

FOR HEATING GAS IS GOOD BUSINESS!

*T. M.-SUBURBAN APPLIANCE CO.

NEW RESIDENTIAL SYSTEM

(Continued from page 16)

nationally known firm of residential architects recognized as leaders in industrialized housing.

Armco announced that many of the new components and systems will be demonstrated in a 28-unit garden type apartment complex under construction in Middletown, Ohio.

Roof-Ceiling System

Among the more significant new ideas incorporated in the Middletown project is a steel roof-ceiling system estimated to save 35% over the cost of conventional roofs. By saving material and erection time, the system is estimated to cost less than $2.00 a square foot, compared with an average of $2.75 for conventional construction.

The roof consists of boxtype ribbed steel panels styled for residential construction. Panels are 24 inches wide and extend from eave to ridge without joints. For maximum watertightness, panels utilize a new anti-siphoning joint. They are made of 24-gage aluminized steel.

Floor Slab Distributes Heat

The Koch floor system has four basic functions: structural slab, sound barrier, finished ceiling and air distribution system. Its main feature is completely integrated duct work that moves the building industry close to the concept of installing heating and cooling by simply "plugging in" mechanical equipment. Cost of the floor unit is estimated at less than $2.00 a square foot, including the air distribution system.

Basically, the floor is an 8-inch deep reinforced concrete slab with T-beam cross section. It is formed by pouring concrete over half-round metal-pan arches laid on a deck of standard interlocking panels.

Window Walls

Key to the new window-wall system is a single basic roll-formed steel section that can "frame-in" a variety of wall and window materials. By modifying it with adaptors and fasteners, this light-gage, C-shaped piece can accommodate fixed and sliding glass and almost any shape wall panel.

To speed erection and reduce costs, the system requires a minimum of field bolting, and no welding. Most connections are made by means of clips, wedges and snap-on devices. Their light weight makes C-shaped pieces easy to handle. Units can be made in either stainless steel or zinc-coated steel, assuring attractive appearance and minimum maintenance.

Sun Screens

All second and third floor windows with south or west exposure will be equipped with exterior sun

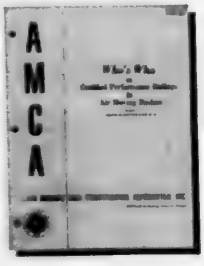
(Continued on page 134)

Who's Who in Certified Ratings?

The first edition of "Who's Who in Certified Performance Ratings" is now available to users and specifiers of air moving equipment. This new publication of the Air Moving and Conditioning Association meets the recognized need for an official directory of manufacturers and products licensed by AMCA to use the Certified Ratings Seal.

The 54-page directory contains essential product identification data on all air moving devices which have been tested and rated for performance in accordance with the rigid requirements of the AMCA Certified Ratings Program. Revised issues will be published periodically.

Copies of Bulletin 261A, "Who's Who in Certified Performance Ratings" are available from: Air Moving and Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Michigan.



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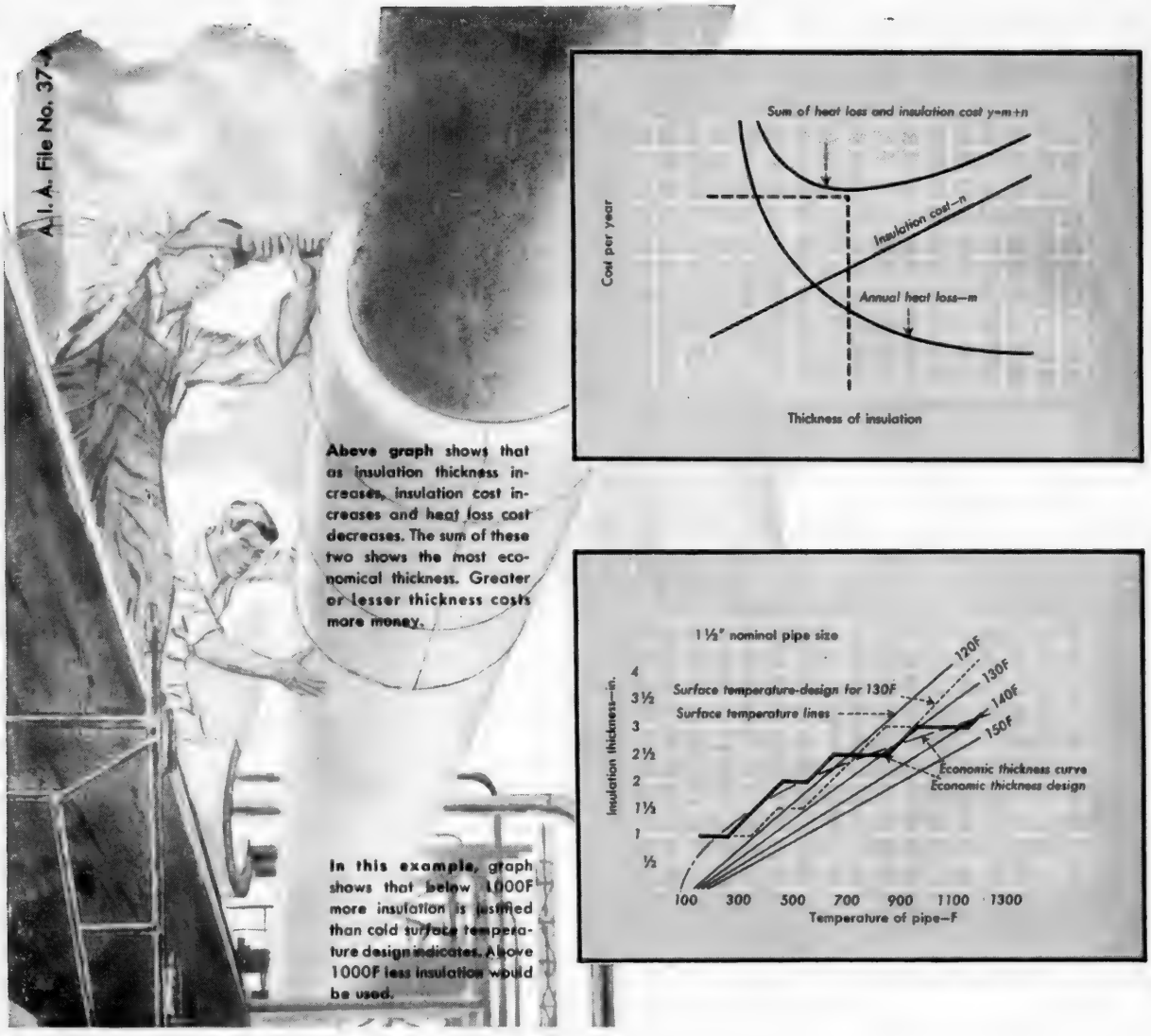


Above graph shows that as insulation thickness increases, insulation cost increases and heat loss cost decreases. The sum of these two shows the most economical thickness. Greater or lesser thickness costs more money.

In this example, graph shows that below 1000F more insulation is justified than cold surface temperature design indicates. Above 1000F less insulation would be used.

"COLD SURFACE" CRITERION WASTES MONEY!

How J-M engineers determine economic insulation thickness

to give you more for your insulation dollar

OVER-ALL cost of the operation should always be the determining factor in selecting insulation thickness. Yet, millions of dollars have been wasted because of rigid adherence to the cold surface temperature method. When Johns-Manville insulation is applied, J-M engineers carefully determine which thickness will provide the greatest operational savings. And this "economic thickness" is usually more (or less) than the cold surface method indicates.

Here's how it works. The annual cost of the heat loss through the insulation is plotted for various thicknesses. Also plotted is the annual cost of insulation. A third curve is then drawn as the sum of heat loss and insulation cost. The economical thickness is found where this third curve reaches its lowest point.

To arrive at the above figures in a given instance requires the following: 1. Cost of heat production per million Btu; 2. Rate of heat loss through insulation in Btu per unit area per hr; 3. Annual hours of operation; 4. Applied cost of insulation per unit area; 5. Rate of amortization and required return on the insulation investment cost. Items 2 and 4 are available from the insulation manufacturer; others are normally supplied by the plant engineer.

For more complete information, call or write Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario. Ask for reprint of technical article "Select Economic Insulation Thickness."

JOHNS-MANVILLE

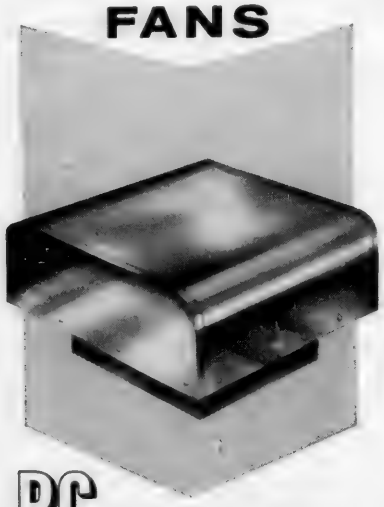
JOHNS-MANVILLE JM PRODUCTS

LOW PROFILE

DAVIDSON

ROOF EXHAUST

FANS



PC *Pleasing Contour Model*

Designed to "hug the roof", the low-contour PC Model is as much as 40% lower than conventional units.

Capacities up to 50,000 CFM with low velocity.

- **Quiet, vibration-isolated operation**
- **Famous Davidson rugged construction**
- **NEMA Standard Motors**
- **Ratings conform to Standard Test Code**
- **Unconditional performance guarantee**

For complete facts about PC Fans and Hyduty SS Fans, write:

DAVIDSON FAN CO.

Dept. L, 213 California St.
Newton 58, Mass.

The original manufacturer of roof fans — Founded 1915

Member AMCA

UNITED STATES DEGREE

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING'S 33rd Year of Publication of Monthly Degree-Day Data

City	October			Season to Oct. 31 from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Abilene, Texas (A)	71	55	98	91	58	153
Albany, New York (A)	335	480	443	414	580	582
Albuquerque, New Mexico (A)	248	256	218	291	259	228
Alpena, Michigan (C)	514	574	530	686	863	745
Anchorage, Alaska (A)	1150	860	912	2178†	899†	1939†
Asheville, North Carolina (C)	295	194	262	344	226	312
Atlanta, Georgia (A)	150	84	110	162	89	118
Atlantic City, New Jersey (C)	155	233	230	165	249	259
Augusta, Georgia (A)	123	76	59	129	76	59
Baltimore, Maryland (C)	153	188	207	165	192	236
Billings, Montana (A)	543	416	497	922	566	691
Binghamton, New York (C)	335	467	428	452	531	569
Birmingham, Alabama (A)	93	99	123	96	99	136
Bismarck, North Dakota (A)	524	551	598	909	779	825
Block Island, Rhode Island (A)	257	309	330	296	388	418
Boise, Idaho (A)	485	377	389	724	440	524
Boston, Massachusetts (A)	246	335	315	297	438	392
Buffalo, New York (A)	323	441	433	399	518	555
Burlington, Iowa (A)	308	312	336	433	357	419
Burlington, Vermont (A)	468	600	521	572	795	693
Cairo, Illinois (C)	156	143	161	172	143	189
Charleston, South Carolina (C)	44	35	34	47	35	34
Charlotte, North Carolina (A)	133	112	147	141	116	154
Chattanooga, Tennessee (A)	178	160	169	187	166	193
Cheyenne, Wyoming (A)	622	496	577	1027	672	818
Chicago, Illinois (A)	293	301	350	370	327	440
Cincinnati, Ohio (C)	190	180	222	212	184	264
Cleveland, Ohio (A)	258	427	340	332	494	415
Columbia, Missouri (A)	232	213	262	312	224	324
Columbia, South Carolina (A)	123	85	76	130	85	76
Columbus, Ohio (C)	237	267	299	280	293	358
Concord, New Hampshire (A)	389	560	527	475	740	719
Concordia, Kansas (C)	225	213	277	370	241	332
Dallas, Texas (A)	49	45	53	50	45	53
Denver, Colorado (A)	459	396	425	732	486	545
Des Moines, Iowa (A)	311	339	355	478	421	454
Detroit, Michigan (A)	276	368	381	340	421	477
Devils Lake, North Dakota (C)	601	610	654	979	840	930
Dodge City, Kansas (A)	247	215	262	373	249	302
Dubuque, Iowa (A)	404	427	444	578	539	593
Duluth, Minnesota (A)	597	607	614	940	906	891
El Paso, Texas (A)	82	86	70	82	86	70
Ely, Nevada (A)	661	574	561	1029	711	789
Escanaba, Michigan (C)	501	529	555	709	748	802
Evansville, Indiana (A)	208	215	215	252	221	274
Fairbanks, Alaska (A)	1353	1190	1163	2448†	2314†	2220†
Fargo, North Dakota (A)	527	538	586	828	761	801
Fort Smith, Arkansas (A)	125	102	131	139	102	140
Fort Wayne, Indiana (A)	339	367	377	418	418	484
Fort Worth, Texas (A)	50	45	58	50	45	58
Fresno, California (A)	126	96	86	126	96	86
Galveston, Texas (C)	7	15	0	7	15	0
Grand Junction, Colorado (A)	367	338	333	562	355	369
Grand Rapids, Michigan (A)	374	413	462	463	503	606
Green Bay, Wisconsin (A)	455	544	515	637	741	698
Greensboro, North Carolina (A)	215	182	202	238	203	231
Greenville, South Carolina (A)	116	106	131	125	109	141
Harrisburg, Pennsylvania (A)	244	307	308	285	330	377
Hartford, Connecticut (A)	330	426	384	393	543	485
Havre, Montana (A)	602	467*	564*	1034	675*	834*
Helena, Montana (A)	649	572	617	1125	814	937
Hicksville, L. I., N. Y.	186	240	(a)	209	264	(a)
Houston, Texas (C)	6	16	0	6	16	0
Huron, South Dakota (A)	452	505	472	728	725	621
Indianapolis, Indiana (A)	276	316	306	336	344	385
Jackson, Mississippi (A)	109	71	69	114	71	69
Juneau, Alaska (A)	760	660	716	1872†	1802†	1850†
Kansas City, Missouri (A)	196	148	240	296	160	285
Knoxville, Tennessee (A)	222	142	179	237	145	212
La Crosse, Wisconsin (A)	375	438	447	563	586	599
Lander, Wyoming (A)	686	549	632	1112	713	876
Lewiston, Maine (O)	417	551	501	513	743	666
Lincoln, Nebraska (C)	268	266	310	451	321	389
Little Rock, Arkansas (A)	120	103	110	130	103	120
Los Angeles, California (C)	32	22	41	34	22	58
Louisville, Kentucky (A)	232	240	232	262	250	283

-DAYS FOR OCT., 1961

City	October			Season to Oct. 31 from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Lynchburg, Virginia (A)	208	226	236	245	255	285
Macon, Georgia (A)	79	67	63	82	67	63
Madison, Wisconsin (A)	444	484	419	632	618	556
Marquette, Michigan (C)	494	509	543	718	752	779
Memphis, Tennessee (A)	148	104	126	156	104	143
Meridian, Mississippi (A)	131	81	90	138	81	90
Milwaukee, Wisconsin (A)	422	494	428	556	636	562
Minneapolis, Minnesota (A)	396	503	459	635	705	616
Moline, Illinois (A)	309	348	96	430	406	96
Montgomery, Alabama (A)	91	64	69	93	64	69
Nashville, Tennessee (A)	186	148	154	209	148	176
New Haven, Connecticut (A)	263	350	363	304	453	456
New Orleans, Louisiana (C)	11	17	5	11	17	5
New York, N. Y. Central Park (C)	168	229	250	188	239	281
New York International	191	242	(a)	219	258	(a)
New York LaGuardia	161	215	250	183	226	278
Newark, New Jersey (A)	200	247	301	221	261	348
Norfolk, Virginia (A)	155	139	152	162	139	161
North Platte, Nebraska (A)	479	389	425	757	513	545
Oak Ridge, Tennessee (C)	237	165	225	259	169	225
Oakland, California (A)	152	140	157	191	215	233
Oklahoma City, Oklahoma (A)	106	96	149	146	98	161
Omaha, Nebraska (A)	283	282	331	429	345	419
Parkersburg, West Virginia (C)	234	256	272	284	270	323
Peoria, Illinois (A)	347	342	339	467	395	425
Philadelphia, Pennsylvania (C)	163	207	219	177	209	252
Phoenix, Arizona (A)	51	16	13	51	16	13
Pittsburgh, Pennsylvania (C)	226	284	298	271	302	354
Pittsfield, Massachusetts (A)	414	539	543	514	729	756
Portland, Maine (A)	433	575	515	537	786	714
Portland, Oregon (C)	316	250	280	428	333	365
Providence, Rhode Island (A)	284	382	381	333	499	488
Pueblo, Colorado (A)	383	330	383	567	371	457
Raleigh, North Carolina (A)	197	170	118	216	181	128
Rapid City, South Dakota (A)	469	407	500	796	561	693
Reading, Pennsylvania (C)	209	285	285	241	309	342
Red Bluff, California (A)	112	53	59	114	53	59
Reno, Nevada (A)	470	493	443	737	620	608
Richmond, Virginia (A)	218	257	210	245	281	243
Rochester, New York (A)	302	452	440	384	535	573
Roswell, New Mexico (A)	194	178	156	215	188	164
Sacramento, California (C)	117	52	75	124	55	92
St. Joseph, Missouri (A)	262	240	233	383	284	282
St. Louis, Missouri (C)	178	193	202	211	198	240
Salt Lake City, Utah (A)	461	420	381	668	436	469
San Antonio, Texas (A)	19	17	25	19	17	25
San Diego, California (A)	33	25	52	33	25	76
Sandusky, Ohio (C)	242	329	327	290	351	393
San Francisco, California (C)	156	141	128	246	310	238
Sault Ste. Marie, Michigan (A)	532	596	639	746	872	937
Savannah, Georgia (A)	66	44	38	69	44	38
Scranton, Pennsylvania (A)	370	446	389	450	538	504
Seattle, Washington (C)	365	298	329	499	444	463
Sheridan, Wyoming (A)	651	506	578	1085	711	817
Shreveport, Louisiana (A)	71	41	53	72	41	53
Sioux City, Iowa (A)	320	336	405	509	432	533
Spokane, Washington (A)	605	503	508	873	656	713
Springfield, Illinois (A)	275	263	259	350	276	315
Springfield, Missouri (A)	214	179	249	283	192	310
Syracuse, New York (A)	292	460	396	362	543	513
Toledo, Ohio (A)	344	394	387	431	458	489
Topeka, Kansas (C)	257	216	242	373	247	284
Trenton, New Jersey (C)	226	285	285	260	316	340
Tulsa, Oklahoma (A)	129	88	152	166	88	170
Utica, New York (O)	183	382	430	196	437	612
Valentine, Nebraska (A)	474	422	461	775	601	606
Walla Walla, Washington (C)	385	292	308	504	333	401
Washington, D. C. (A)	181	212	231	197	219	263
Wichita, Kansas (A)	184	171	219	270	184	251
Williston, North Dakota (C)	563	532	605	959	741	866
Winnemucca, Nevada (A)	512	518	508	810	627	688
Yakima, Washington (A)	524	431	446	726	576	596

a) Data not available.

† Includes July and August.

* City office data.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with three exceptions, based on local Weather Bureau reports. Exceptions are Utica, Lewiston, and Hicksville, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., Norman E. Ross, Bursar, Bates College, Lewiston, Me., and Long Island Lighting Co., Mineola, N. Y., respectively.

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Differential Pressure Switches

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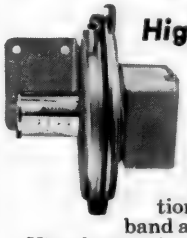
Sensitive ... but small

Compact, low cost, highly sensitive to differential pressures in ranges from 0.15″ to 80″ water. Holds set point through various total pressures. Virtually unaffected by vibration. Use in any position. *1800 Series.* Write for Bulletin E-40.



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Repetitive accuracy within 1% in pressure ranges too low for conventional switches. Dead band as low as 0.03″ water. Visual set point, tamper proof calibration. No drift or hysteresis error. High static pressures. *1630 Series.* Write for Bulletin E-30.

Double Circuit Control with Center Null Area

Dead band spans pressure control range—two micro-switches actuate separate circuits at high and low limits. Ranges from 0.15″ to 24″ water. *1627 Series.* Write for Bulletin E-20.

Variations For Special Applications

For example—open contact null type switch for controlling reversible blower motors ... or for pressures up to 100 PSIG with range of 4″ of w.c. differential pressure ... engine intake air filter switches ... high/low alarm actuation for telephone circuit tie-in ... extremely-low-range magnetic double circuit switch for upper/lower environmental limit control.

Give us details of *your* special low-range differential switch requirements. We'll recommend a pressure switch suited to your needs.

F. W. DWYER MFG. CO.

P.O. Box 373-N • Michigan City, Ind.

NEW RESIDENTIAL SYSTEM

(Continued from page 130)

screens that move in sliding tracks. They are estimated to save 15 tons of air conditioning in the Middletown complex. Made of porcelain enameled expanded metal, the screens will be operated from inside by either manual or motorized power.

Panel Wall System

Three steel-panel curtain wall designs developed by Koch will be demonstrated in the project. Styled to create wall textures of residential character, the 16-inch wide panels are roll-formed with vertical ribs in three patterns.

The 1½-inch prefinished panels will be backed with 1 x 3 wood furring and a 2-inch insulating blanket with integral vapor barrier and one ⅜-inch gypsum wallboard.

ASHRAE RESEARCH CONTINUES AT UNIVERSITY OF FLORIDA

The American Society of Heating, Refrigerating and Air-Conditioning Engineers has concluded an agreement with the University of Florida, whereby the latter will continue the study of air-conditioning loads due to insolation, carried on by the Society in recent years. The terms of the agreement include the transfer of the Society's solar calorimeter with instrumentation and all scientific equipment from its Cleveland laboratory to the University in Gainesville.

RESEARCH RESIDENCE READY FOR MILD CLIMATE STUDIES

Extension of the National Warm Air Heating and Air Conditioning Association's research program to the West Coast has begun, with installation of test equipment underway in a new research home at San Jose, California, according to an article in *The Bulletin*, published by National Warm Air Association.

Studies at the home will be carried out by faculty members of the college to determine air conditioning characteristics of a crawl-space home in a mild climate area.

S. Brooks Walton, head of the Mechanical Engineering Department at San Jose State will head the faculty group responsible for instrumentation, testing and preparation of reports.

Lists of research projects under consideration were submitted by the committee to dealer-contractors as well as other segments of the West Coast industry for opinions on the relative importance of various research needs.

Tests will utilize insulated and uninsulated ducts in crawl space. Floor to ceiling, wall to wall, and room to room gradients will be checked along with air velocities, distribution and draft conditions. All tests will cover both heating and cooling, except that no cooling tests will be made with un-insulated ducts in a vented crawl space.

During the crawl space plenum tests it is recommended that temperatures be checked in the plenum, at the outer edge of the foundation, and in soil near the foundation and 3 inches below the surface.

OUTLOOK STATEMENT PREDICTS BIG YEAR FOR CONSTRUCTION

According to the annual outlook statement released by F. W. Dodge Corporation, construction will enjoy its best year in history and set a new record for the 17th consecutive year.

The statement, just published in Architectural Record, predicts that total construction contracts in 1962 will amount to nearly $40 billion, a gain of 7% over the estimated $37.3 billion for this year.

The Dodge outlook forecasts a 6% increase in heavy engineering.

DRY and CLEAN AIR at the RIGHT TEMPERATURE

- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity

Air Condition by the NIAGARA Method Using HYGROL® Liquid Absorbent

This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years or service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because...the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because...you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY
Dept. HV-12, 405 Lexington Ave., New York 17, N. Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

METERED OIL SUPPLIED TO HOMES FROM SINGLE STORAGE FACILITY

A system for central distribution of residential fuel oil, which eliminates the storage tank from individual homes, has been developed by Tri-State Pipe Lines Corp., New York, N. Y.

Installations involving 1700 houses are now under contract in home developments in Poughkeepsie, N. Y., Washingtonville, N. Y., and Old Saybrook, Conn. Present negotiations involve an additional 3,200 houses.

The system, built around the development of meters for individual houses, makes it possible to supply homes with fuel oil from a single underground storage facility at no cost to either the builder or the buyer. Tri-State will install in new housing projects, at no cost, a complete meter-oil system. The system includes: all mains, supply piping and components; underground fuel storage tanks with a reserve capacity adequate to supply a full supply of fuel even in the severest weather; and a special Slo-Flo meter, which can accurately measure the flow of fuel-oil to a home at the low rate of flow required by home fuel oil heating.

Tri-State will also undertake to obtain at no charge to either builder or buyer, all easements, permits and zoning consents and approvals of governmental authority having jurisdiction.

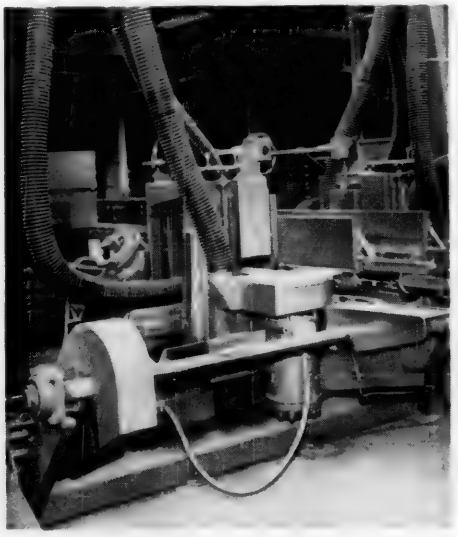
The system works as follows: (1) Bulk fuel oil deliveries are made at the central storage tanks; no deliveres are made to individual homes; (2) Oil is filtered as it leaves the tanks; (3) Where site topography requires, pumps develop pressures in the distribution systems for delivery to house heating equipment. If practical, tanks are located for gravity distribution; (4) Service lines, branching from the street mains, deliver oil to individual houses; (5) Oil is metered (in tenths of gallons) by individual house meters as it is used in the home heating equipment.

A single 10,000 gallon supply tank is shown being prepared prior to removal to a plot adjacent to the residential project. The storage property will then be landscaped. Two tanks supply 50 residences.

FLEXAUST® HOSE

Dust Collection for Fume Control Materials Handling

MAKES GOOD INSTALLATIONS BETTER



Thousands of successful installations prove that use of Flexaust hose and Portovent retractable duct with metal duct systems lower installation costs — but there are other important advantages.

Exceptional abrasion resistance
Corrosion resistance
Noise absorption
Durability under heavy flexing
Provision for expansion and contraction
Easy relocation of hoods and machines

Made of high quality neoprene coated fabrics 1¼ to 36" i.d.

Write today for full details

Distributors in all principal cities

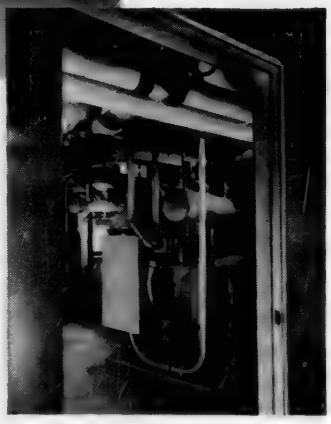
THE FLEXAUST CO.

DEPT. HV-12 100 PARK AVE. NEW YORK 17, N. Y.

"Hot" Brain requires Cool Treatment

To process 2,400 checks a minute and provide fast service for its 75,000 checking accounts, the First Wisconsin National Bank of Milwaukee is spending more than $1,500,000 for an automated check handling system second to none.

▲ A view of the First Wisconsin National Bank's new automated check processing system currently geared to handle about 500,000 checks a day. Shown is the computer room. Sorter room is to the left. A third area, the printer room, completes the installation.



This Vilter Uni-Chiller maintains the required temperature with a capacity of 61.8 tons with 55° entering water and 45° leaving water. ▶

● Currently programmed to process the avalanche of 500,000 checks a day . . . 2,400 a minute . . . is the new, fully expandable automated "brain" check handling system built especially for the First Wisconsin National Bank of Milwaukee.

The "hardware" used in this amazing system—computers, high speed magnetic tape machines and printers, multiplex control, document sorters and check encoders—generate substantial amounts of heat which must be rapidly dissipated to protect both the components themselves and the accuracy of the processing.

To help maintain the critical temperature and humidity levels within the glass-enclosed 8,000 square foot area, a Vilter UF-6, flooded type, R-22 Uni-Chiller was installed. Cooling coils are mounted in a plenum chamber with air distributed into the conditioned area through a slotted acoustical tile ceiling. This method of air distribution produces an imperceptible movement of air for maximum comfort of personnel in the room.

You benefit with Vilter refrigeration and air conditioning equipment in two important ways—(1) careful design and precision fabrication result in long life . . . reliable, efficient performance . . . minimum maintenance; (2) a complete and integrated line of equipment, and the experience to counsel you on the best type of installation. Why not let the nearest Vilter representative help you.

System designed and installed by Thos. E. Hoye Heating Company of Milwaukee

Vilter® refrigeration air conditioning

Vilter Manufacturing Corporation
Milwaukee 7, Wisconsin

Air Units • Ammonia and Freon Compressors • Two-Stage and Booster Compressors • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice Machines Liquid Transfer Systems Air Agitated Ice Builders

Write for helpful bulletins to the Vilter Manufacturing Corporation Dept. G61-1 2217 South First Street Milwaukee 7, Wisconsin

BRIEFLY STATED NEWS ITEMS

An amendment to the Chicago Building Code to authorize specifically the installation of room heaters with sealed combustion chambers has been passed by the City Council. A heater of this type is placed on the inner surface of an outside wall with a dual-purpose vent passing through it. Most other cities also permit this type of installation. THE PEOPLE'S GAS LIGHT AND COKE COMPANY said the heaters draw air for combustion from outdoors and discharge products of combustion directly into the atmosphere. They are made by a number of manufacturers and are approved by heating experts.

WITH THE ENGINEERS

Charles J. Allen, Associate in the firm of ALBERT KAHN ASSOCIATED ARCHITECTS AND ENGINEERS, INC., was appointed assistant chief mechanical engineer. Mr. Allen joined Albert Kahn Associates in 1955. Three years later he was admitted to membership in the firm and in 1959 was named chief engineer of the Heating Division which he will continue to head in his new position. He is a registered professional engineer in both mechanical and chemical engineering. He also holds certificate from the National Board of Engineering Registration. . .

Herbert R. Smith has joined the organization of VALLEY ENGINEERING CO., Glenside, Pa. Mr. Smith, formerly with United Engineers and Constructors, H. A. Kuljian Co., and Catalytic Construction Co., has had fifteen years experience in commercial and industrial plumbing and piping design.

ASSOCIATION ITEMS

Charles W. Lockhart was elected president of AIR MOVING & CONDITIONING ASSOCIATION, INC. About 130 AMCA members, representing seventy manufacturers of air moving and conditioning equipment, held their seventh annual meeting in September, to outline industry

plans for 1962, and elect new officers and board members. Mr. Lockhart comes to his new post well prepared, having served several terms on the board of directors. He has also been active in Association work and has served as chairman of both the Centrifugal Fan Division and the AMCA Steering Committee. He is currently vice-president in charge of sales for Buffalo Forge Company. At the convention, the Association approved the adoption of a recommended practice covering the measurement of sound in fans and air conditioning devices. Previously, AMCA has provided manufacturers and purchasers of air moving and conditioning equipment with standard test codes that establish uniform test methods for performance ratings. The following AMCA officers were named for 1962: vice-president, L. A. Macrow, chief engineer, Carrier Air Conditioning Company, Division of Carrier Corporation, Syracuse, N.Y.; vice-president, R. C. Niess, manager of product sales, York Division, Borg-Warner Corporation, York, Pa.; secretary-treasurer, John F. Tobin, vice-president of marketing, American-Standard Industrial Division, Detroit. The following new board members were elected: Marc McGuire, division manager, Utility Fan Corporation, Division Utility Appliance Corporation, Los Angeles; Robert E. Parker, vice-president and chief of research, Ilg Electric Ventilating Company, Chicago; Geoffrey G. Workinger, vice-president of sales, McQuay Incorporated, Minneapolis; Robert A. Wasson, president, Clarage Fan Company, Kalamazoo, Mich.; William H. Rodgers, manager, Temper-Air Group, American Air Filter Company, Inc., Louisville, Ky.; Edward J. Stone, sales manager, Propellair Division, Robbins & Myers, Inc., Springfield, Ohio; George V. Patterson, president, Swartout Fabricators, Inc., Kokomo, Ind. . .

A. O. Smith Company has become a member of the Residential Division of BETTER HEATING-COOLING COUNCIL. The company will be represented by L. W. Roye, market manager-hydronics, consumer products division. . .

Roger E. Gay, former president of Bristol Brass Corporation, will

This WHEEL

MAKES LEHIGH I. E. INDUSTRIAL FANS IDEAL FOR TOUGH INDUSTRIAL EXHAUST APPLICATIONS

Handles dust-laden air and gases, paper shavings and the like without clogging

Lehigh Industrial I.E. Fans . . . featuring heavy duty, unique channel construction, all-welded mild steel wheels of the long shaving design . . . solve difficult exhaust problems because of their non-clogging characteristics. They incorporate a universal housing, which permits rotation and discharge to be modified to facilitate variable field conditions.

A complete range of sizes is available in both 70° to 250°F and 251° to 600°F construction. All standard drive arrangements are available and will be furnished according to your specifications.

Rugged, air-tight construction: the fan housing is welded on the inside with a continuous fillet weld. This provides gas-and air-tight housing with joints of maximum strength.

Standard, self-aligning ball-bearing pillow blocks . . . grease lubricated . . . are featured on all Lehigh Industrial I.E. Fans.

Optional accessories include an inspection door, inlet and outlet flange, heavy duty housing construction, and drain plug.

Get detailed information on how Lehigh I.E. Industrial Fans can solve your industrial exhaust problems with dependable non-clogging performance. Your Lehigh Representative will be happy to supply you with full details. Or, if you choose, write directly to us for Bulletin L-5:

2172
LF-2

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BOILER FEED WATER TREATMENTS
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AIR CONDITIONING AND BOILER SCALE REMOVERS
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As They Have For 40 Years, Engineers Everywhere Today Rely On METROPOLITAN'S Quality Chemical Maintenance Products And Consulting Services.

Through Scientific Field Surveys And Laboratory Analyses METROPOLITAN Works Closely With You To Find The Right Answers To Your Specific Problems.

To Prevent Or Eliminate Problems Of Scale, Corrosion, Slime, Soot, Slag, Sludge Caused By Impurities In Water And Fuels . . . In Boilers, Cooling Towers, Evaporative Condensers, Storage Tanks, Steam & Return Lines, General Water Supply Systems . . . In Industrial Plants, Office Buildings, Apartment Houses, Public Institutions, Hotels, Theaters, Stores . . .

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succeed Vice Admiral George F. Hussey, Jr., U.S.N. (Ret.), as managing director of AMERICAN STANDARDS ASSOCIATION, effective January, 1962. The Association is the coordinating body and clearing house for voluntary national standardization. It is a federation of 126 national trade associations, technical societies, professional and consumer groups, composed of some 2200 companies. . .

Frank F. Burrows was nominated president of ASSOCIATED GENERAL CONTRACTORS OF AMERICA for 1962 at its midyear meeting of the governing and advisory board in New Orleans. Charles Keller, Jr. was nominated vice-president of the Association, whose 7,300 member firms perform approximately 80% of all contract construction in the United States each year. Mr. Burrows, a building contractor, is now vice president of the AGC. Mr. Keller, a heavy construction contractor primarily, is now chairman of the AGC's labor committee, a national director from Louisiana, and a member of the executive committee. . .

Frederick S. Burroughs was named vice-president of NATIONAL OIL FUEL INSTITUTE at its annual meeting October 17 in New York. Mr. Burroughs, secretary of the Institute and managing director of its Promotion-Communications (Refiner) Division, played a major role in the growth of oil heating market advertising programs from their start of $360,000 annually in 15 cities in 1954 to current total oil heat advertising budgets almost nine times as large in more than 80 cities. Under his guidance NOFI's refiner-distributor promotion, through chapter cooperative advertising programs, will expend a total of more than $3,000,000 to promote oil heating in 1961.

BURGEONING BUSINESS

SARCO MFG. CORP., Bethlehem, Pa., has begun construction of a multi-million dollar factory in Allentown, Pa., that will provide a completely integrated plant and facilitate an orderly program of future expansion. Total initial floor

space of the structure is 113,400 square feet, planned to accommodate 500 employees. It is located on a 22-acre site near the Queen City Airport. The single-level building will house manufacturing, warehouse, office, and cafeteria under one roof and is scheduled to be completed and ready for occupancy in June 1962. . .

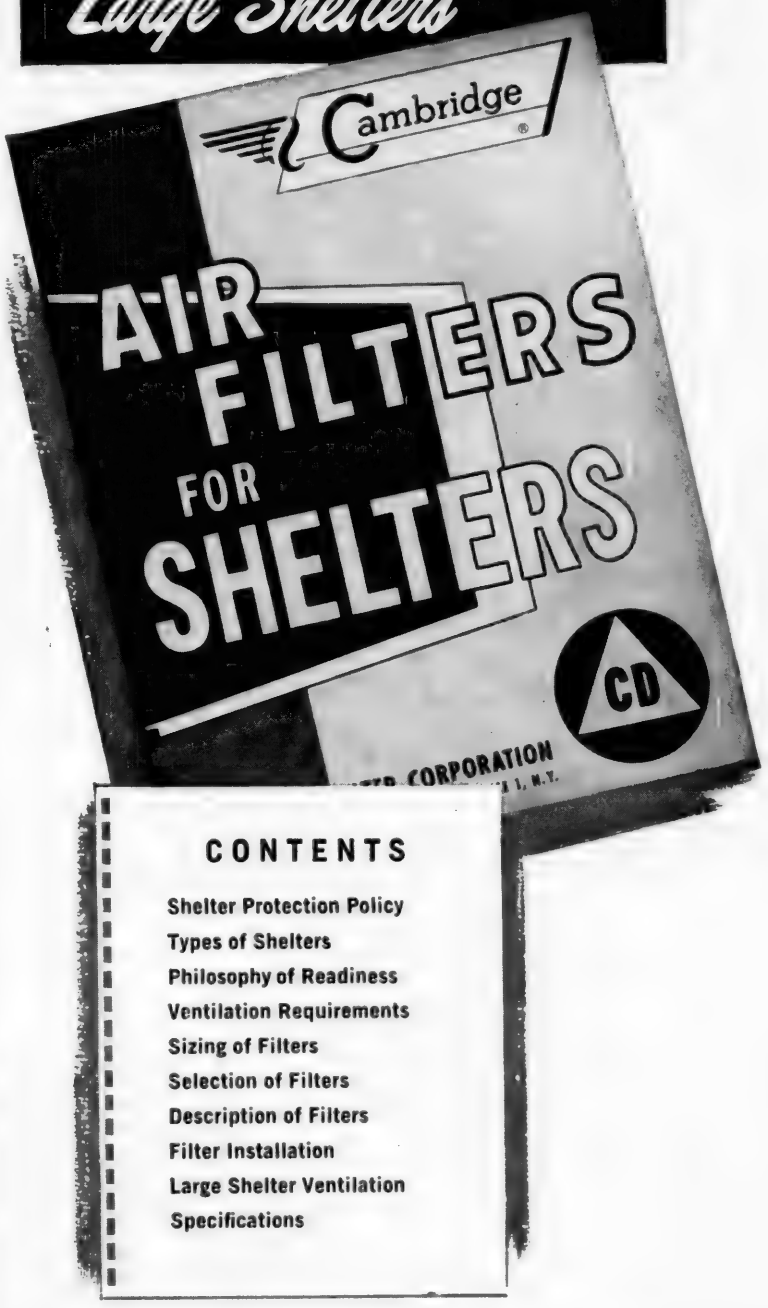
VAPOR CORPORATION (formerly Vapor Heating Corp.) has acquired the business and assets of the Transit Division of National Pneumatic Co., Inc., Boston. The company will become NATIONAL PNEUMATIC DIVISION OF VAPOR CORPORATION. Its customers include metropolitan transit authorities, bus manufacturers as well as manufacturers of railroad cars. . .

Architect John S. Bolles, of San Francisco, has been assigned the design of a new assembly and distribution plant in Wiesbaden, West Germany for Ray Olbrenner GMBH. The facility, which will be triple the size of the present plant at Frankfurt, will be the center for the operations in Europe of RAY OIL BURNER CO., San Francisco, Calif. Mr. Bolles reported that the site has been selected and Ray has approved preliminary plans by his office and Consulting Engineer Franz Springer, of Wiesbaden. The 20,000 square foot plant will employ 40 to 50 people. . .

A contract for construction of large additions to the WESTINGHOUSE ELECTRIC CORPORATION air conditioning division plant at Staunton, Virginia, has been awarded to Nielson Construction Co., Harrisonburg, Va. The majority of work in the $2 million expansion program will consist of the addition of about 55,000 square feet of warehouse space. A new single story office building adjacent to the existing engineering laboratory will also be erected, making it possible to place all the division's engineering, drafting, laboratory and model shop personnel in one location. The construction is scheduled for completion in the second quarter of 1962. . .

BELL & GOSSETT COMPANY has proposed the acquisition of REZNOR

This Book Will Help You Design *Large Shelters*



CONTENTS

- Shelter Protection Policy
- Types of Shelters
- Philosophy of Readiness
- Ventilation Requirements
- Sizing of Filters
- Selection of Filters
- Description of Filters
- Filter Installation
- Large Shelter Ventilation
- Specifications

This booklet outlines present OCDM recommendations and indicates types of equipment available to meet future requirements necessitated by changing weapons capabilities. It has been prepared by the makers of the world-famous ABSOLUTE filter – pioneers in the development of A.E.C. filters.

If you are responsible for the design of large shelters, write for a copy.

Cambridge Filter Corporation
734 East Erie Boulevard, Syracuse 1, N.Y.

MANUFACTURING COMPANY, Mercer, Pa., on an exchange of stock basis. Reznor shareholders will receive 18¼ shares of B&G common for each share of Reznor; 479,975 shares of B&G stock would be exchanged in the transaction. The acquisition is subject to approval by Reznor's 90 shareholders, who will vote at a special meeting on Nov. 2. The newly acquired company will be operated as a wholly owned subsidiary of Bell & Gossett, with no proposed changes in management. David R. Webster will continue as president of Reznor. . .

Products Division of TODD SHIPYARDS CORPORATION has established district sales offices at San Pedro, Calif. and Brookline, Mass. Mr. J. A. Hayes III has been appointed district manager of the West Coast office located at head of San Pedro Channel, and will be responsible for the promotion of Todd's combustion equipment in Pacific and Mountain states; California, Oregon, Washington, Utah, Colorado, Montana, Idaho and Arizona. The New England district office, located at 1318 Beacon Street, Brookline, will be headed by Mr. M. G. Magoulas who will be responsible for the promotion of Todd sales in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut. . .

Four firms in the heating equipment industry, all based in Philadelphia, have merged to form REPCO PRODUCTS CORP., an integrated manufacturer of a complete line of heating equipment. All American Products Co., Republic Products Co., General Heating Products Co., and W. H. Bunten Co. are the firms which have merged to form the new organization. Repco Products Corp. now offers research and development, manufacturing and production facilities and a nation-wide sales and distribution network. The research and development and manufacturing facilities of the new company are headquartered in Philadelphia, Pa. Sales offices for the firm are located in Boston, Hartford, New York, Philadelphia, Baltimore, Richmond, Clearwater, Detroit, Chicago, Salt Lake City, San Francisco, and Seattle.

NEW REPRESENTATIVES

HYDROTHERM INC., Northvale, N.J. has appointed HILDEBRAND & ASSOCIATES, Elyria, Ohio, as its representative in the northern part of Ohio. William C. Hildebrand and John V. Farrell will handle Hydrotherm's full line of eleven sizes of residential gas-fired boilers. . .

JOHN J. NESBITT, INC., Philadelphia, Pa., has appointed three representatives to handle its product line in their respective areas. They are: Fess-Sieve & Co., Shreveport, La.; The Roberts Co., Kansas City, Kan.; and Rex W. Williams & Sons, Salt Lake City, Utah.

* * *

William Todd Miller, authority on heating, refrigeration and air conditioning, and a popular member of the Purdue University faculty for nearly 30 years, died last month. He was 73. The Purdue student chapter of ASHRAE makes an award in his name to the outstanding student in his field each year.

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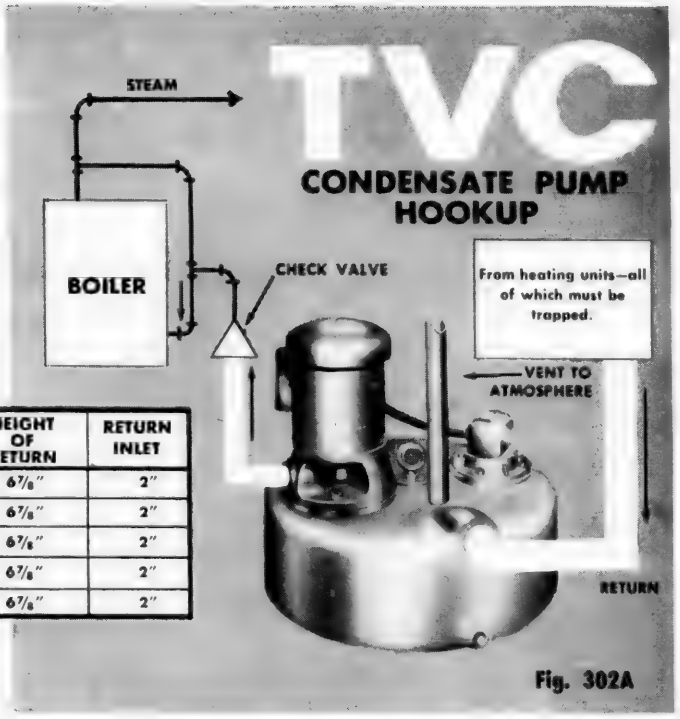

Fig. 302A

UNIT NO.	SQ. FT. E.D.R.	CAP. G.P.M.	H. P.	PUMP DISCH.	HEIGHT OF RETURN	RETURN INLET
TVC 19	750	1.5	¼	1"	6⅞"	2"
TVC 23	1000	1.5	¼	1"	6⅞"	2"
TVC 29	2000	3.0	¼	1"	6⅞"	2"
TVC 35	4000	6.0	¼	1"	6⅞"	2"
TVC 41	6000	9.0	½	1"	6⅞"	2"

Discharge pressure: 20 lbs. P.S.I.

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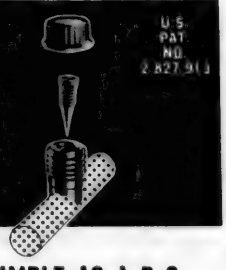

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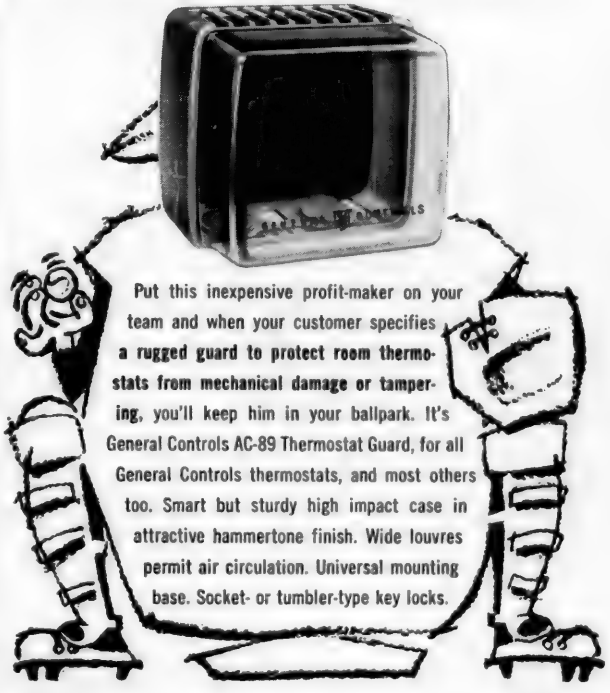

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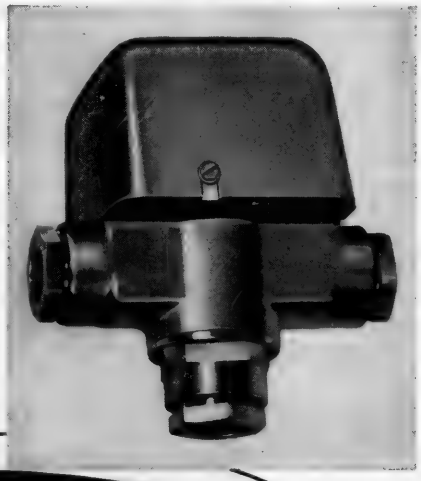

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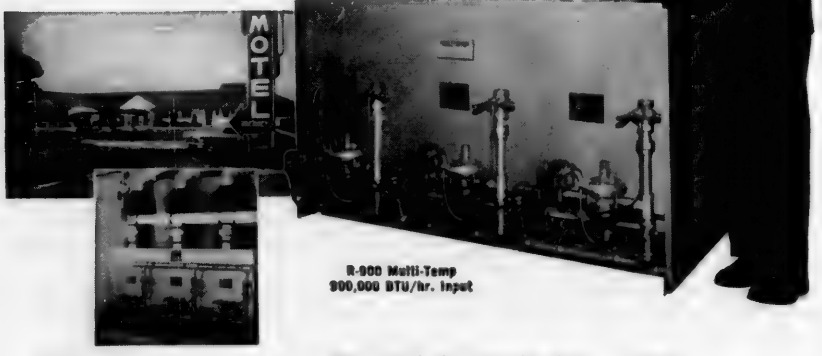

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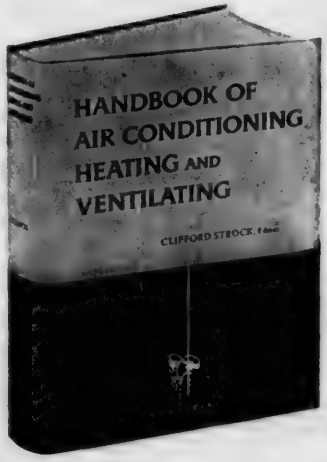

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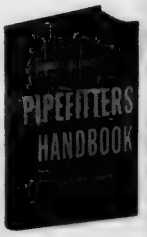

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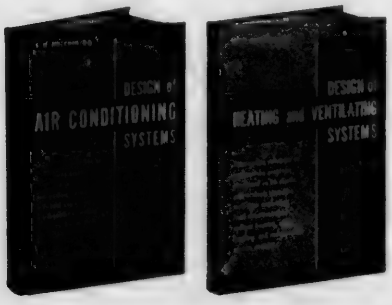

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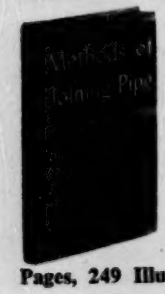

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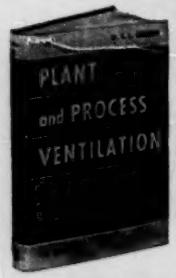

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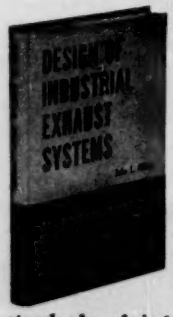

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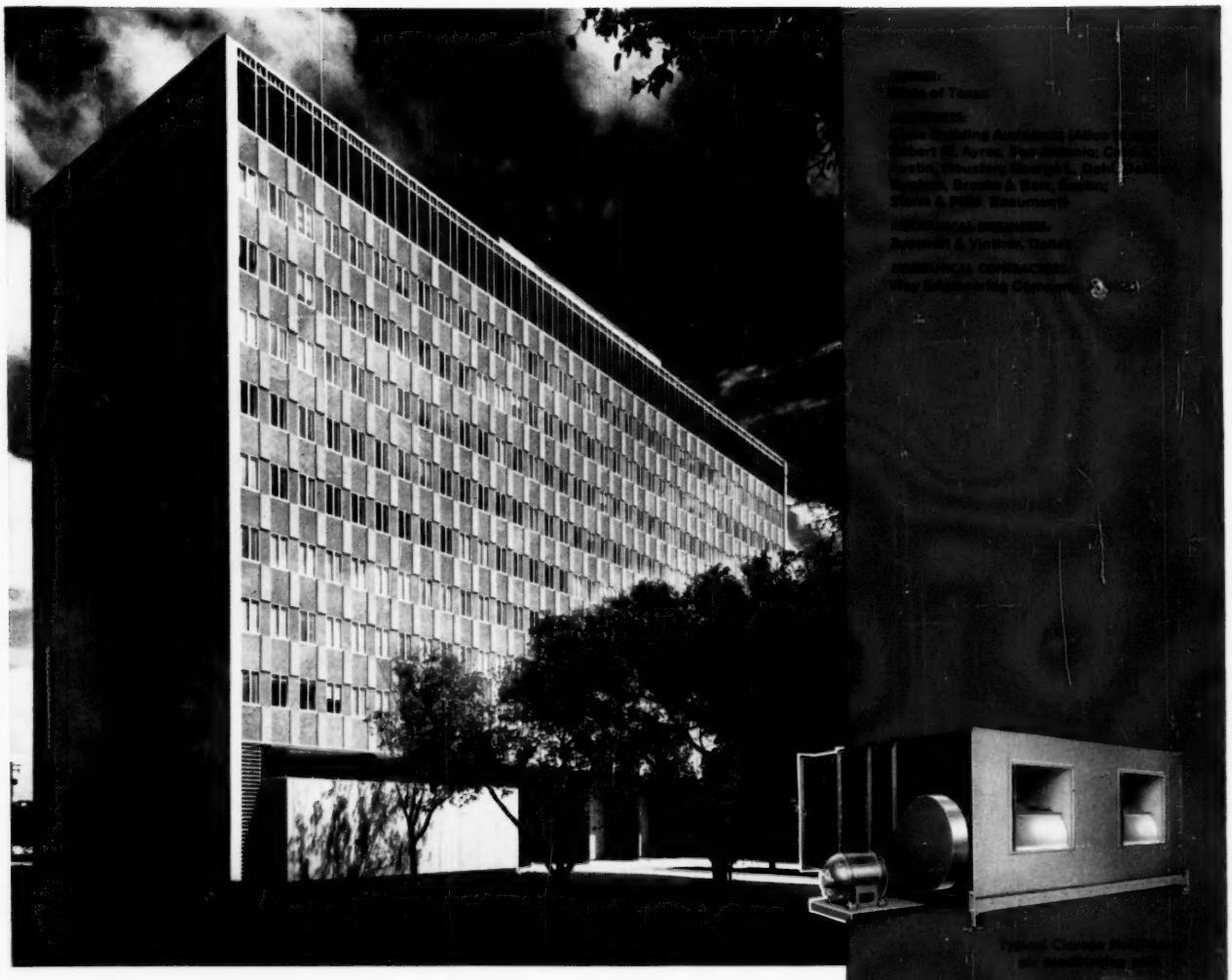

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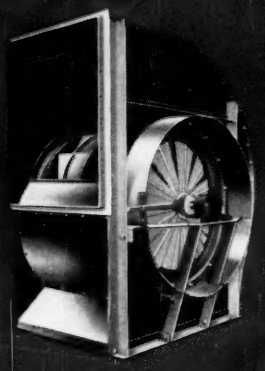

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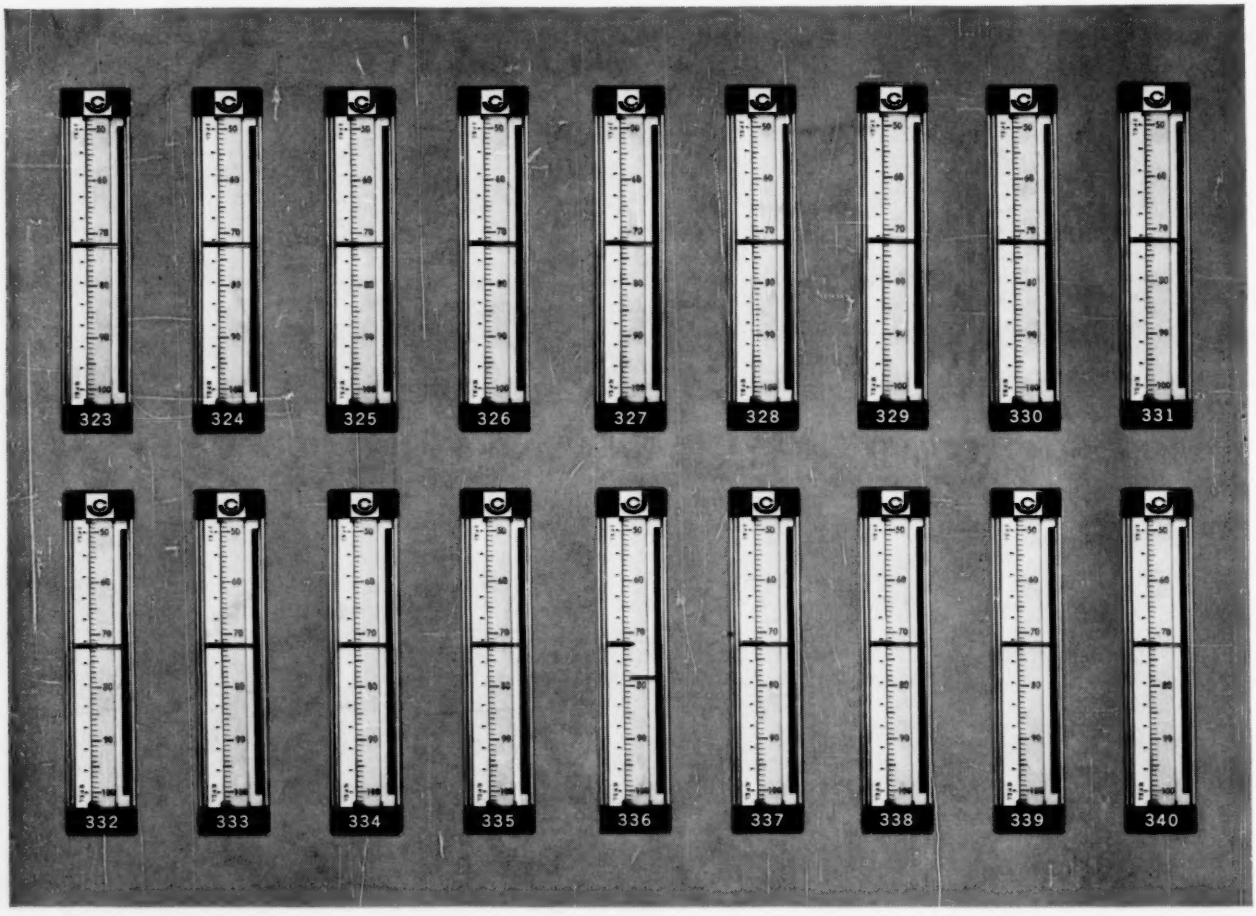

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